Electrical World

The Consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. XLVIII. NEW YORK, SATURDAY, SEPTEMBER 22, 1906. No. 12.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

114 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 7605 CORTLANDT. CABLE ADDRESS ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....1139 Monadnock Block
PHILADELPHIA OFFICE.....Real Estate Trust Building
CLEVELAND OFFICE.....405 Cuyahoga Building
EUROPEAN OFFICE.....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION

United States, Canada, Cuba and Mexico.....Per year, $3.00
Foreign Countries, within the Postal Union.....$6.00
25 shillings. 25 marks. 25 francs.

Foreign subscriptions may be sent to our European office.
Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to September, 1904, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

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Entered as second-class matter at the post office at New York, N. Y.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Of this issue of the ELECTRICAL WORLD *16,000 copies are printed. Total circulation for 1906 to date, 713,000, an average of 18,763 per week.*

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CENTRAL STATION USE OF CURRENT.

Few articles of more general interest have appeared of late in our columns than that which occupies several pages this week on the use which the New York Edison Company makes of its own electrical energy. There are, of course, a great many other corporations in the country in the electrical field which are energetic in giving evidence of the faith that they have in their product, but at the same time it is a matter of regret that the majority of electric lighting companies do not yet seek as they should opportunities to exemplify the manner in which electricity can be used in the office, the factory and the household.

There is great virtue in an energetic and systematic canvass; there is merit in a follow-up system; there is virtue in brisk advertising. But when all is said and done, the best line of argument for a company to follow is to show in its own practice how electricity can be employed. The uses of current by the New York Edison system are so various it has been difficult even within the compass of this long article to enumerate them all, but when our readers note those which have been instanced or illustrated, we think they are likely to be encouraged themselves to follow up some of these lines of work if they have not yet done so. It is obvious that the company should run its elevators with electric motor and should have numerous electric automobiles, while it is equally natural that it should be lavish in its employment of electric signs, which are indeed the badge of its occupation, but it would not readily occur to everybody that the company also points its office lead pencils by electrically-driven sharpeners, dictates its correspondence to electrically-operated phonographs, uses electricity in its photographic developing room and has electric fans for drying the plates. When such minor details as these are attended to, it follows as a matter of course that the company has its electrical kitchen and does its refrigeration also electrically.

All such work as this encourages the idea and belief that the miscellaneous uses of electricity will soon appeal as strongly to the public as do those which deal with the great, broad interests of illumination, motive power and transportation. There is an infinite number of ways in which electricity can subserve the public necessities, and such educational methods as those of the New York Edison system are heartily to be applauded and wherever possible should be imitated.

THE PRECISION OF ELECTRICAL MEASUREMENTS.

As an art progresses greater and greater refinement is the natural result of increasing attention to detail and a wider knowledge of the conditions to be met. This is true not only as regards ultimate exactness but with respect to purely commercial requirements. As electrical distribution has increased in importance, the methods of measurement have kept pace until one may now feel fairly well contented with them. It is only a few years ago since ammeters and voltmeters were of the crudest description and wattmeters almost unknown. Thanks to the energy and skill of a few American makers, commercial instruments of very high quality are now available. It is one of the cases, however, where the practical and commercial has

more than kept pace with the theoretical in development, so that inexact measurements may far oftener be charged up to the user than to the instrument. As a matter of fact, the commercial measurements of electrical energy compare very favorably indeed with the commercial measurements of other commodities in spite of the fact that the limits of precision in electrical work are not altogether satisfactory.

Now electrical measurements may be made relatively with good precision, but the absolute units are still rather uncertain. The ohm, for instance, is certainly dubious to several hundredths of a per cent and the volt is little better. The ampere stands on a somewhat higher plane of accuracy. All told, the value of electrical energy in absolute measure is a quantity not determinable at present with the exactness which would generally be considered satisfactory in physical measurements. Yet in spite of this, the commercial measurement of electrical quantities compare extremely well with any others. Lengths, in every day work are seldom exact to better than a tenth per cent and about the same figure holds for time. Weights as determined in every-day transactions are often in error by several per cent, especially since spring balances are so often used; and volumes are commonly erroneous by a much larger amount and generally scant at that. Any one who takes the trouble to measure carefully an alleged quart of anything liquid will get a startling side light on "commercial" accuracy. Try, for example, a so-called quart bottle of milk and receive a view of measures as they are worked in practice. Of course, the American legal gallon is an especially small unit, but one-fifth of it is not an honest quart on any scale of reckoning. Now, electricity is sold by meter like gas, and the gas meter is perhaps the most fluently abused metrological instrument, yet if it did not give fairer measure than the coal ton, or the milk quart or the beef pound, the meanest company that ever dispensed water gas would hang its official head in shame.

It is to the incidental errors that especial care should be directed in station and general commercial work, for they are commonly neglected and are sometimes very troublesome. One buys, for instance, a high-grade station voltmeter. Carefully used it should not be in error by more than a quarter of one per cent even after a long period. Let it be badly placed, subject to stray field and vibration, and used on abnormal voltage, and it will very soon require recalibration. There may be, too, errors caused by inaccurate transformation ratio in the potential transformer or by improper connection or overload upon it. In case of ammeters used with current transformers, there is an ever greater likelihood of such disturbing factors, for changes in power factor and wave shape cannot be neglected. When it comes to wattmeters or watthour meters there is a double chance of uncertainty, a chance quite generally improved, and persistent recalibration is the price of precision. In shunted instruments still another opportunity for change of constants occurs. Even in so-called standard instruments used for comparison, experience has shown that considerable errors may creep in, none the more welcome for taking their origin in improper use. It requires great vigilance to keep the instruments of a station in proper condition. Of course, small errors are generally not serious. There are tests, however, where the differences become important, and a few cases, such as measuring the total output of a station, in which great precision is needful, since even one per cent means a pretty large sum. Customers' meters are the electrical instruments most subject to criticism, generally without sufficient cause. It is astonishing how nearly even a meter with a poor calibration curve will give accurate results in a year's run, provided it is carefully installed and used at a proper rating. Like a watch it may not hold a consistent rate, but month in and month out will keep very excellent time. And a thoroughly good meter really gives a remarkable performance even though occasional tests may show errors of two or three per cent at particular loads. The casual aberrations of portable instruments are quite comparable with those of a good meter, so that testing the latter in position is by no means as complete a check as it appears to the uninitiated.

The Alternating-Current D'Arsonval Galvanometer.

The great advantage of the D'Arsonval direct-current galvanometer in regard to sensitiveness is attributable to the fact that the angular movement of the coil and of its attached pointer depends upon the product of the ampere-turns in the coil and the magnetic flux linked with the same. This magnetic flux, instead of being produced by the current to be measured, is supplied by a relatively powerful permanent magnet. Consequently, a relatively small number of ampere-turns in the coil, i. e., a relatively feeble current, can set up a strong deflecting torque, thanks to the powerful magnetic field constantly maintained. In the case of an alternating current passing through the ordinary D'Arsonval moving coil, the torque is reversed at each alternation, and the resultant deflection is substantially zero. If, as in the alternating-current dynamometer type of galvanometer, an alternating magnetic field is produced by the current to be measured, this field becomes very feeble with feeble currents, and the deflecting torque is therefore much weaker than in the direct-current instrument. Within recent years, however, endeavors have been made to excite an alternating magnetic field for an alternating type of D'Arsonval galvanometer; or to use an ironclad type of alternating-current dynamometer.

The article on page 569 of this number, by Profs. Franklin and Freudenberger, describes a form of alternating-current D'Arsonval instrument of the shunt magnet type. The electromagnet has a laminated core and is excited from alternating mains through an adjustable choking coil and condenser, in such a manner as to have the alternating magnetic flux substantially in phase with the e.m.f. between the mains. When the movable coil is traversed by this flux an alternating e.m.f. is induced in it, as in the secondary coil of a transformer. As soon as the circuit of the movable coil is closed externally a secondary current is induced therein and a unidirectional pulsating torque is thereby set up on the coil, even although no current is supplied to the coil from an external source. The coil is, however, allowed to assume a definite position under this torque, by means of an adjustable external resistance, and then the alternating current to be measured is superposed upon the steady secondary current in such a manner as to bring about a measurable deflection. It is stated that the sensitiveness of the alternating-current D'Arsonval galvanometer is of the same order of magnitude as that of the direct-current instrument, a somewhat surprising result. The D'Arsonval galvanometer as used in the above manner is certainly more complex than the ordinary direct-current instrument. It is influenced by the phase relation between the exciting field current and the current to be measured, passing through the circuit of the movable coil. Moreover, there is likely to be eddy-current electromagnetic disturbance on the movable coil, as well as

electrostatic disturbance between the field and armature coils. The deflections produced by a given current strength through the movable coil are also subject to variation with frequency. At the same time it is often so important to secure sensitiveness from an alternating-current galvanometer that many objections or difficulties may be gladly encountered to secure it. We may reasonably hope that skill in design may minimize these difficulties in the future and make the alternating-current D'Arsonval galvanometer an available instrument. There are many directions of investigation with high-frequency alternating or oscillating currents which would be much simplified by the development of an alternating-current galvanometer as sensitive as the direct-current D'Arsonval instrument, and as reliable in its indications.

THE FLAMING ARC ABROAD.

We abstract in the Digest this week a long paper on the new flaming arcs read before the Institution of Electrical Engineers, which is notable as being particularly devoted to the discussion of the Carbone type of arc in which, as our readers are doubtless aware, ordinary carbons are used instead of the somewhat expensive impregnated carbons of the ordinary flaming arcs. The necessity for these special carbons is at present regarded in this country as almost prohibitive of their use, and figures have been brought out to show that the flaming arc does not pay in central station use. Of course, the present prices of the special carbons in this country are fanciful in the extreme since the chemicals employed in the cores are very cheap, and when required in considerable quantities the impregnated carbons will be very little higher in cost than the ordinary sort. It is, however, very interesting to note how good results can be obtained merely from common carbons when so arranged that the craters are fully exposed, and little light intercepted by the carbons themselves. From the figures presented by Mr. Andrews in this paper it is clear that by far the largest source of loss in the common arc lamp is in this interception of light, since the theoretical light distribution from the positive crater is such as necessarily is interfered with by the lower carbon to nearly the extent indicated by the difference in efficiency between ordinary arcs and the Carbone arc.

In actual figures the efficiency of the Carbone arc is stated to be practically three times greater than in the common enclosed arc, basing the comparison on lower hemispherical candle-power, while still remaining at less than half the value reached by the flaming arcs with impregnated carbons. Mr. Andrews credits the enclosed arc with about .77 cp per watt, while the Carbone arc gives 2.24 and the flaming arc 5.80. The gain in the Carbone construction is an obvious and necessary one, and what is almost equally important, there is a great improvement in color value, the violet hue of the enclosed arc being replaced by a pretty good white in spite of the length of the arc. This color difference seems somewhat extraordinary since the voltage in the two cases is nearly the same, i. e., nearly 80 volts. The Carbone arc, however, is customarily made for rather large current and the brilliant white light from the crater is not cut off, nor is it much absorbed by the somewhat diffuse surrounding flame. In the enclosed arc not only is much of the crater light cut off, but the residuum is subject to rather strong absorption. In fact, examination of an ordinary enclosed arc with the spectroscope shows that the light from the crater is rather weak, and that from the arc relatively strong. Be this as it may, the Carbone arc seems to have many excellent properties which place it in a position demanding very respectful consideration. American station managers are so mindful of labor costs that they will naturally shy at anything requiring much trimming, but it should be mentioned for their consolation that Mr. Carbone claims a life of 300 hours without recarboning for a form of lamp now being developed.

One would hardly expect from these smaller sizes as great efficiency as from the 10-amp. lamp on the performance of which the data given were based; yet it is certain that the freedom from light interception given by the inclined carbons exposing the craters fully must produce a material gain in efficiency under any and all conditions. The same advantage is gained in the ordinary flaming arcs, of which considerable numbers are in use in England with highly satisfactory results, and in several different forms. The strongly selective radiation of the regular flaming arcs is responsible for the very high efficiency, and likewise for the somewhat objectionable hue, which in the golden arcs most commonly seen is as wide of daylight as an enclosed arc or a worn-out Welsbach. When the carbons are so modified as to give essentially white light the efficiency falls off to a point little better than that reached by the Carbone arc with its plain carbons. Incidentally it should be noted that the lamp with inclined carbons, whether impregnated or not, has the advantage of giving a steady light on alternating circuits at frequency considerably lower than is feasible for a lamp with co-axial carbons in which only one crater at a time is fully exposed to view.

The English station manager, by the way, is hard up against the gas arc with high-pressure gas, a form of competition with which we in this country are little familiar. Abroad the gas arc is a grim reality and has shown itself capable of pushing ordinary arcs very hard, especially where relatively small units are to be employed. The flaming arc has been an invaluable weapon of defense in this sort of competition, and has shown itself able to beat out the gas arc at its own game of cheapness, to say nothing of quality. The arcs are in larger units and give naturally a tremendous effect of brilliancy in addition to their actually great measured light. The immense globeful of light produces astonishingly effective illumination, and the cost per candle-power hour has in the English tests beaten out the gas arc by more than two to one. In this country the pressure of competition with gas in public lighting is not so keenly felt, but if the time comes when the issue is forced foreign practice plainly shows that in the flaming arcs the central station man holds command of the game. The cost of operation is given by one of the English users as down to 0.8 cent per 1,000 m.s. cp-hours exclusive of carbons, reckoning energy at 4 cents per kw-hour. Here the cost of trimming is much higher than abroad and carbons cost more, so that a longer burning lamp at slightly less efficiency might well prove more economical. If Carbone comes out with a lamp of 300 hours' life between trimmings it will be welcomed. Then, too, there is the Vogel flaming arc working in mercury vapor and claimed to burn more than 1,000 hours with one pair of carbons while working at 0.2 to 0.4 watt per cp. It is clear enough that there are likely to be considerable improvements in the flaming arcs, and from the extent to which they are now being used abroad the changes in the art should be rapid. Such an arc giving reasonably long burning would be quickly taken up in this country. The present types make way slowly on account of the labor of trimming and the cost of carbons, but the indications are that these are but temporary conditions. It will pay the central station man to make a close study of foreign practice and to be ready to get into line when the psychological moment arrives.

New Boston Edison Building.

The Boston Edison Illuminating Company will soon occupy its handsome new ten-story building on Boylston Street, between Washington and Tremont Street, which will contain several features of unusual interest.

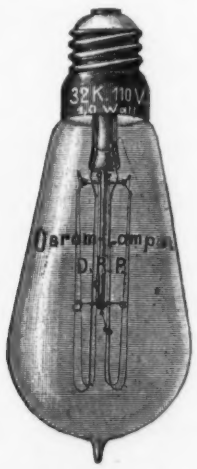
The design of the illumination of the building was placed with a commission consisting of Dr. Louis Bell, Mr. L. B. Marks and Mr. W. D'A. Ryan, who have introduced a number of entirely new features in interior lighting which, together with the results of the careful study of the best illumination for every case presented, will render the building of unusual interest to electric lighting visitors.

For the benefit of the lay public the basement and ground floor will be used for the exhibition of every kind of electrical appliance. Over 250 separate exhibits have already been arranged for and manufacturers are invited to enter exhibits of modern electrical apparatus and appliances of interest to the central station customer. Working exhibits will be maintained without cost to exhibitors, and no charge will be made for space.

The Osram Incandescent Lamp.

The German Welsbach Company has placed its new lamp on the market, and from an advertisement in a German periodical the following claims for it are extracted: This lamp was described in our issues of September 1 and September 8, and is **similar to a one made in Vienna** under the name "Osmin" lamp. The filaments in both cases are an alloy of osmium and tungsten (Wolfram) the latter largely predominating. We understand that this type of lamp is soon to be placed on the market by an American company.

The advertisement claims a consumption of one watt per hefner candle, or a saving of 70 per cent of electrical energy in comparison with carbon filament lamps. The lamp comes to candle-



OSRAM LAMP.

power immediately upon turning on current. The candle-power is constant; according to tests of the Reichsanstalt of 32-cp osram lamps for 110 volts, the decrease of candle-power after 1,000 hours was only 4 per cent. The light is claimed to be pure white. The radiation of heat is 70 per cent less than with carbon lamps. The life is claimed to be very long. The lamp is made for all voltages between 100 and 130 at the following prices: 32 hefners (29 cp), 75 cents; 50 hefners (45 cp) 81 cents; 100 hefners (90 cp), $1.25; 100 hefners, globular shape, $1.38. The accompanying illustration is reproduced from a cut in the German advertisement.

Rejuvenation of the Sons of Jove at Niagara.

One of the features of the convention of the Electrical Jobbers, held last week at Niagara Falls, was the Rejuvenation of the Sons of Jove. This organization was founded some years ago in Texas. It had a very limited membership at first, but a couple of years ago a rejuvenation was held in Chicago and since that time, largely owing to the efforts of Mr. C. B. Roulet, there have been rejuvenations held in other cities, so that to-day the membership is in the neighborhood of 600, about one-third of whom are central station managers and the other two-thirds engineers, contractors, jobbers, manufacturers, salesmen, representatives of the technical press, etc. Some eighty new members were admitted at the Niagara Falls rejuvenation.

The order was originally founded for the purpose of bringing together its members in a social way by holding rejuvenations in various cities and at conventions, etc. Back of that there is a more serious object, viz.: the co-operation of its members in advocating a more extended application of electricity so that every member feels that every wearer of the R. S. O. J. badge is working for his interest as well as their own. The badge is recognized all over the United States, and with the organization growing at the pace it now is, there is every reason to believe that it will become a potent factor in the electrical field. Its lodge ritual is an interesting one and its constitution is founded largely upon the Order of the Hoo Hoos, who have become so powerful an organization in the lumber trade.

A meeting of the Sons of Jove was held the night after the rejuvenation at Niagara Falls, at which a number of speeches were made and much enthusiasm about the future of the organization displayed. There will be another rejuvenation at Columbus, Ohio, during the street railway convention, another is planned for Boston the last week in this month, and still another in St. Louis a little later on. A large number of applications for initiation at these various rejuvenations are in the hands of the secretary. Anyone wishing to make application for membership can do so by communicating with Mr. C. B. Roulet, Wilson Building, Dallas, Texas.

Convention of the Vermont Electrical Association.

One of the most enjoyable conventions ever held by electrical men in northern New England was the fifth annual meeting of the Vermont Electrical Association, which occurred at St. Johnsbury on September 12 and 13. About sixty central station managers, engineers and supply men were present, and a large amount of pleasure was covered in the programme, in addition to the regular business meeting. On the first day the entire party was conveyed in a special train of the St. Johnsbury & Lake Champlain Railroad to Lake Park, in West Danville, Vt., where a baseball game and other sports were enjoyed, followed by a regular shore dinner served by the association under the auspices of the Consolidated Lighting Company, of Portland, Me. The second day began with trips in barges to the power plants of the St. Johnsbury Electric Company, and the works of the Fairbanks Scale Company were also thrown open to the members and guests in attendance.

At the Avenue Hotel, which was headquarters for the convention, the General Electric Company had in operation a complete electric kitchen with two young lady demonstrators who practiced the culinary art upon visitors. The apparatus exhibited included a large three-heat oven, chafing dish, coffee percolator, quart and pint heaters, broilers, double boiler and steamer combined, grids, stateroom and bathroom heaters, flatirons, frying pans and glue pots. The exhibit was in charge of Mr. J. A. Wilson, of the Boston office. The H. K. Paiste Company displayed a number of wiring specialties, in charge of Mr. Frank Booth, and the Wagner Electric Manufacturing Company, of St. Louis, exhibited a ½-hp, 104-volt, single-phase induction motor, speed 1,750 r.p.m., 60 cycles, direct-connected to a ½-in. Morris centrifugal house pump with automatic ball float and starting switch, capacity 5 gal. per minute against 50-ft. head. This outfit was wired and piped for actual operation and its points of interest were demonstrated by Mr. Brooks Faxon, Boston manager of the Wagner Company. The first cost of this equipment, complete, was given as about $150, and a similar set is now in operation at the Boston Edison Company's Head Place exhibition rooms.

A new departure in instrument design was shown by the

Wagner Company in the form of a portable combination indicating volt and wattmeter, for both alternating-current and direct-current service. The instrument carries a lamp socket on its face and is especially designed to enable a central station man to make voltage and watt tests of lamps on the actual premises of complaining customers, and on the basis of its readings explain how the customer's bills are made up. The instrument shown was provided with a switch which enabled it to be operated upon either 110 or 220-volt circuits. The company also exhibited a wattmeter reading directly in kilowatts, edgewise type. The Westinghouse Electric & Manufacturing Company, represented by Mr. L. Watts and Mr. C. P. Wahn, of the Boston office, showed its latest types of prepayment and registering watt-hour meters. The Allis-Chalmers Company, represented by Mr. C. M. Dering, distributed publications of its products at the hotel, as did the Cooper-Hewitt Electric Company, represented by Mr. D. C. Crosby. In the afternoon of the second day the annual business meeting of the executive committee was held and the following officers were elected for the year of 1906-7: President, Geo. S. Haley, Rutland; first vice-president, E. E. Larrabee, Bennington; second vice-president, F. H. Parker, Burlington; secretary and treasurer, C. C. Wells, Middlebury. The executive committee consists of Frank Collins, White River Junction; J. E. Davidson, Montpelier; C. E. Parker, Vergennes; F. H. Foote, St. Albans, and E. D. Blackwell, Brandon. This meeting was followed by a lawn party, at which many ladies were present, at the home of Col. T. C. Fletcher, president of the St. Johnsbury Electric Company.

The technical meeting of the convention was held in the evening of the 13th at Pythian Hall, the subject being a paper upon "Recent Improvements in Incandescent Lamps," by Francis W. Wilcox, of the General Electric Company. In the unavoidable absence of the author the paper was read by Mr. T. J. Brown, of the Boston office. An abstract of this paper will appear next week.

Mr. Brush and His Work.

A recent interview in the Boston *Globe* presents Mr. C. F. Brush in an interesting light, as he appears in Cleveland to-day, enjoying the fruits of a useful life and attending regularly at his office with hours 11.30 to 12. Speaking of his early work in arc lighting he said:

"The capacity of the first French machines was but one light apiece. They never could have been successfully used except in a very limited way. With the current of my dynamo, however, I could light 2 and then 4 and then 16 lamps. To-day dynamos are manufactured which light 125 lamps.

"Thus, what we call series arc lighting was made practicable, and a whole city could be illuminated from a central station.

"During the summer of 1876 I took my first dynamo to my father's farm, and there, where no one could see me, gave it a thorough trial. Two horses from the plow supplied me with power. So far as I could judge, the machine was a distinct success.

"That autumn a company in Cleveland began to manufacture it for electro-plating purposes. At that time the use of electricity was limited to telegraphing—a single message on a single wire—to door-bells, annunciators in hotels, burglar-alarms and plating. While my dynamo was given over to electro-plating, my purpose all along was to make a machine that would successfully and economically produce light.

"Late in 1876 I ran a wire from our little factory to the roof of a building on the public square in this city. I set up a lamp and during a parade of soldiers in the evening threw my light into the street below and the eyes of the men and their horses. That was the first public exhibition of the arc light.

"The men in the parade were confused, and there was some trouble with their horses. The police scrambled to the roof and, in more roughness than I thought to be necessary, stopped me.

"Dr. Longworth, of Cincinnati, was our first customer. He bought a dynamo and lamp—I had also invented a lamp—and I set them up.

"In 1878 I made it possible to operate a machine at a central station and to light lamps in a series and long distances apart. The first series plant, a six-light machine, was sold in December to a clothing dealer in Boston.

"Twelve arc lamps were hung in the public square of Cleveland in April, 1879, and thus was inaugurated the era of street lighting by electricity. Sixteen-light machines followed, and in 1880 we were making dynamos of 40-light capacity.

"We sent a 16-lamp outfit to London in 1880, and the Anglo-American Brush Electric Company was organized, the capital of which was $4,000,000. In 1882 we exhibited our light in the main street of Tokio, Japan."

As to future developments, Mr. Brush remarked: "Ten thousand able men are investigating and experimenting in all parts of the world. We may have no important discoveries for ten years —that happens sometimes. Then they follow in quick succession and startle mankind. I believe the telephone to be the greatest discovery of the age. We could use steam for power and gas for lighting, but there is no substitute for the telephone.

"Radium, a marvelous revelation of one of the secrets of nature, may help to clear up the mysteries which now conceal the truth concerning electricity and gravity and work other wonders of which we little dream."

Municipal Ownership at the Edison Convention

At the recent convention of the Association of Edison Illuminating Companies, Mr. Arthur Williams presented an interesting paper on "Municipal Ownership," embodying not only a philosophic review of the situation, but a large amount of data. It was pointed out that England's municipal indebtedness, according to the last available figures, now amounts to £2,345,000,000, and there is evidence of a strong counter movement looking to the material curtailment of the functions of the municipalities. Lord Avebury in a recent address pointed out that the capital expenditure in the electric lighting undertakings alone now amounts to £27,000,000, upon which last year a "profit" was claimed of £339,000; that only 1 per cent was allowed for depreciation, which he called absurd. If as little as 2½ per cent had been set aside for depreciation, he says, this item alone would have amounted to £673,000 and "would have turned the so-called profit into a heavy loss." He also pointed out that of forty-eight municipalities working tramways only thirteen contribute to the rates; seventeen make no depreciation allowance and only eleven make over 2 per cent. He adds, "We all know how disastrous the steamers of the London County Councils have been and continue to be."

At Bristol careful investigation is now being made into the conduct of municipal trading enterprises. Mr. Featherstone Witty, speaking before the Industrial Freedom League, describes them as being in a most unsatisfactory financial state. After careful investigation, as a member of a commission appointed for that purpose, he says with regard to municipal trading generally in Bristol, that the results from a financial point of view have been very disappointing to the ratepayers; that the electrical as well as the dock enterprises of the city have been conducted "on financial principles which leave much to be desired from the point of view of soundness."

The Parliamentary Electric Lighting Act stipulates that an undertaking established under it shall provide a reserve fund with a portion of its surplus, and that this reserve fund shall be invested outside of the undertaking itself in approved "trustee securities." During his investigation Mr. Witty found that the sum of £5,000 had been allowed as a reserve fund; when asked where it was invested he was told "in the unexhausted borrowing powers of the committee." "That is to say," continuing to quote Mr. Witty, "supposing the committee had authority from the Local Government Board to borrow £100,000, it registered a self-denying ordinance in its minute book that instead of borrowing £100,000 it would borrow only £95,000." This is the way the reserve fund of £5,000 had been "invested."

Under the title of "Some Lessons in Municipal Trading," *Engineering*, of London, of August 3, 1906, is responsible for the statement "that in view of the County Council elections next

spring an organized campaign is to be undertaken to awaken the electors of London to a due sense of their responsibility in connection with the administration of the municipal affairs of the metropolis." The same article points out that during the first year of the municipal steamboat service on the river Thames the receipts fell short of the working expenses by £50,095—$250,000. The expenditure for this service is placed at £293,136—$1,465,000. As the receipts fell short of the working expenses, it is to be presumed that no allowance was made for depreciation, which at the moderate allowance of 7½ per cent would amount to an additional loss of $109,926, or a total loss of more than $360,000.

The same authority points out that according to the annual report of the London tramways the surplus balance is £31,249—$156,000—on a capital expenditure of over £3,000,000—$15,000,000. This is one-tenth of one per cent upon the investment, for which, presumably, no depreciation or reserve funds have as yet been accumulated. Notwithstanding a showing so pitifully inadequate the London County Council intends to expend £756,000 for additions and equipment during the year to come.

Soliciting and Advertising.

Mr. H. K. Mohr read a paper at the recent convention of the Association of Edison Illuminating Companies, at Frontenac, N. Y., which dealt with the cost of, and results from, soliciting and advertising as demonstrated by the methods in vogue and results obtained by the member companies. To this end thirty-one questions had been framed, eighteen on soliciting and thirteen on advertising, covering the subject broadly. These questions were printed upon sheets for convenient reply and mailed to every company in the association. An analysis of the replies obtained discloses the fact that the cost of soliciting for all companies approximates 1 per cent of the gross revenue. The population per solicitor varies from 10,000 to 75,000, the average figure being about 25,000 for the smaller companies. There appears to be considerable unanimity among the member companies as to the proper average salary of a solicitor, the figure of $900 per annum being that which appears most frequently. Straight salary without premiums is the almost universal method of paying a solicitor. The smaller companies do not subdivide the work of the soliciting department. As the companies develop, however, there is a tendency to break up the soliciting department into distinct branches. The popular method of keeping track of the solicitors' work is through the medium of reports which are forwarded daily to a record clerk at the main office for file and follow up. The policy of making free sign installations seems to be generally accepted as good practice.

Advertising costs of the member companies varied from 0.25 per cent to 2.50 per cent of the gross revenue, the average figure being 1.25 per cent. An analysis of the answers received shows a considerable unanimity in thought regarding the most efficient method of expenditure, and a composite opinion upon the handling of a given appropriation would be approximately as follows: Spend three-fifths upon a follow-up campaign of direct mail advertising; spend one-fifth upon newspaper and street car advertising; spend one-fifth upon miscellaneous advertisng, including bulletins, stuffers for bills, etc.

Hints on Illumination.

In a paper read by Mr. Stephens B. Burrows before the Association of Edison Illuminating Companies at its convention held at Frontenac, N. Y., many practical hints were given on the proper selection of lamps for various purposes of commercial illumination. For theatre lighting every lamp should be concealed from view or equipped with a covering globe. Studded lamps are the most appropriate in this class of illumination, and the 16-cp or 32-cp incandescent lamp is the best for this purpose. A good style of illumination for churches is cove lamps in conjunction with a general illumination, the hidden lamps to be used when the sermon begins and the visible sources to be dimmed. For ballrooms the requisite uniform illumination can be secured by studding small units over the ceiling and upper walls. In banks and office buildings the general illumination should be designed not only to light the lower region of the public space, but to throw enough light on the ceiling and upper side walls to bring out the decorations and lines of the building. Single lighting units properly shaded should be placed at each desk.

In the cases of stores where economy is the first consideration the best result is generally obtained from incandescent units at a height of from eight to ten feet from the floor and with arc lamps from twelve to fifteen feet high. A good arrangement for window lighting is a trough reflector used in conjunction with an electrolier which is fitted with holophane globes. The best arrangement for picture galleries is the trough reflector. In factory or machine shop lighting the problem is generally the same as in a large office building; each operator should have a unit over his machine, while additional general illumination should be provided. For the latter purpose the Nernst lamp has proved most satisfactory.

Development of Victoria Falls Power.

A recent dispatch from the Transvaal discusses the proposed Victoria Falls power scheme, and says: "An authoritative Transvaal engineer indicates the amount of power which the African Concession Syndicate would be able to draw from the falls as 275,000 hp, and it is clear that this enormous amount of power would be more than sufficient to cover all the requirements of the whole of the Transvaal and Rhodesia. It is stated in one case the capital of the company to be formed will be $15,000,000, but in another statement it would seem that in addition to this debentures will also have to be issued to the extent of probably $11,000,000, the presumption being that the promoters will also claim $5,000,000 for the concession. It appears that for depreciation purposes about $1,260,000 will be necessary, and as much more for interest, cost and administration. The engineer interviewed says that it is hard to see, even for an optimist, where the requirements for electrical energy could be found which would justify such a huge undertaking.

"It would appear that the Chartered Company undertakes to find the capital for shares and the Allgemeine Electricitäts Gesellschaft the capital for debentures. It is denied that the scheme is to be controlled by German financiers, but it would appear that the order for the electric installation for the principal plant has already practically been placed with a German firm, states the engineer.

"The high cost of development, it is thought by another engineer, can hardly stand up against the proportionate cost of steam plants on the Rand, and the correspondent adds that the scheme would not be feasible unless electricity could be supplied at guaranteed regularity at under one cent per unit."

The Future of Wireless Telegraphy.

Mr. J. Henniker-Heaton, who has been the prominent advocate in England of cheap postage and cheap telegraphy, says in the *Nineteenth Century* in regard to wireless telegraphy: "May I be allowed to sum up one or two considerations as to the probable influence of wireless telegraphy on the future of our race? In the first place, a severance of communication with any part of the earth—even the antipodes—will henceforth be impossible. Storms that overthrow telegraph posts and malice that cuts our cables are impotent in the all-pervading ether. An explorer like Stanley in the tropical forest, or Peary amid ice fields, will report daily progress in the *Times*. Every wandering tramp steamer will have its wireless spar, and will be in constant touch with vessels that dot the ocean all about it. Sir William Preece's dream of signaling to Mars may (say by utilizing Niagara for the experiment) yet be realized.

"A governing fact is the cheapening of the new force. Everything essential to human happiness is cheap—air, water, the bountiful fruits of the earth—and electricity is no exception.

Hitherto the cost of wires has kept this blessing from the bulk of mankind. Already the Marconi company (in a letter which I possess) offers to telegraph to India at half the present rates, and Mr. Marconi promises messages to America at a penny a word. The speed attained is twenty-five (or with two sets of apparatus, fifty) words a minute.

"For some time wireless telegraphy will not replace wire and cable systems, but it will supplement and cheapen them, coming to their aid and the aid of humanity in case of mishap, and meanwhile cutting down rates.

"Our ultimate ideal must be instantaneous electrical communication with every man on earth, ashore or afloat, at a cost within the reach of every one. To profit from this human necessity is as wrong as it would be to tax speaking or walking. It follows that all the machinery of the world's communications should belong to the State. Let our government rise to the occasion and buy up all the British cables and wireless company's shares at the market price of the day on which this review appears. Whether this suggestion will please those companies I know not. I have no pecuniary interest in any; my one thought is, as it always has been, to secure the best, cheapest and most widely available communication between man and man."

Alternating-Current Elevators.

A paper read at the recent convention of the Association of Edison Illuminating Companies by Mr. E. W. Lloyd gave an outline of the relation of the alternating-current motor to central station business, and showed the present status and future possibilities with reference to alternating-current elevators. Several manufacturers in Chicago have equipped their factories with traveling cranes using three-phase motors. These equipments, while not perfect, are reliable enough so that the parties using them are well satisfied. Alternating-current motors are also being used with jib cranes, printing presses and with ladles in foundries. Alternating-current motors are not, however, as yet suitable to meet conditions required in individual driving. Such motors equipped with back gears would find a ready market to-day, and the demand for them is continually increasing.

Manufacturers are ready to place on the market a polyphase motor for elevator service that has been perfected to such a point that its operation is quite satisfactory, it being claimed that the machine takes about double full load current in starting. The elevator equipment can be provided with either alternating-current magnet controller or direct-current magnet controller; in the latter event the direct current is obtained from a small dynamo driven from the worm shaft.

The author stated that the elevator companies are able to build any type of machine, and it makes little difference to them whether or not the customer uses central station service. The electric lighting companies should take hold of the situation in a methodical manner, and obtain accurate information regarding the cost of operation of the different types of elevators, especially the alternating-current elevator to which power can be supplied directly through stationary transformers without rotary converters.

Prizes for Suggestions from Employes.

Our London contemporary, the *Electrical Review*, prints in a recent issue a discussion by Mr. W. O. Horsnaill of the system of inviting sugestions from employes for improvements in methods of manufacture or in design. He refers to the practice in this country and in view of the interest the matter is now attracting in Great Britain, he sets forth some of the principles which he considers apply to the case.

The relations between employer and workman are now completely of a business nature, and the advent of old age pensions and the State-aided provision of work for the unemployed will eventually deal the death blow to any sentiment which may have struggled on through the competition of recent years, as with such provision for the destitute, employers will have no compunction in turning their men adrift whenever it suits their purpose to do so. The present position, therefore, may be laid down as follows: The workman is engaged to do certain work during a definite number of hours in each week, with the full knowledge that during periods of slackness or from other causes his services may be dispensed with at short notice. Under these conditions he cannot fairly be expected to do extra work excepting for additional pay. When the arrangement between master and men is regarded in this light, it is obvious that if the latter are asked to suggest improvements for the benefit of the former they should be offered payment in some form or another for doing this work which is no part of their regular duties. It may even be stated that to invite suggestions without any offer of adequate payment for those adopted, does positive harm.

Take the case, for instance, of a man who has suggested an improvement which enabled certain articles to be produced for 60 per cent of their previous cost, thus obtaining large profits for his employers. No doubt at first he will be flattered by the attention which his invention has attracted, but as time goes on, unless his position or wages are advanced, he will be permeated by a sense of injustice which will be freely imparted to his comrades. It would often be impossible or impolitic to advance such a man's position or wages, and if a number of men employed in a works, whose ideas had been adopted, were to take a similar view, the result would be a general feeling of suspicion which would injure the relations between the workmen and the management for many years.

Having decided that rewards or payments are just and essential, it becomes necessary to consider in what form and to what extent they should be made. The National Cash Register Company, of Dayton, Ohio. in whose works a successful suggestion system has been in force for about two years, has chosen the plan of making a small payment for every idea offered immediately its adoption has been decided upon, followed by a competition for a certain number of quarterly prizes, the initial payment being one dollar and the prizes ranging from 50 down to 10 dollars. It is doubtful whether this scheme of payments can be improved upon, provided that a sufficient number of prizes be given to cover at least 50 per cent of the competitors, so that each of the latter would have an even chance of obtaining something more than the initial payment for his invention. The immediate cash payment is, undoubtedly, a good feature, and one which will appeal especially to men in receipt of weekly wages.

A somewhat similar method of obtaining suggestions from workmen was adopted a few years since by Messrs. G. & J. Weir, Ltd., of Glasgow, a certain sum being set aside every month by the firm to be paid away in prizes to the men who put forward the most useful ideas. The latter are judged by what is known as the "Friction Club," which is composed of all the heads of departments and the various shop foremen, meetings being held once a month for this and other purposes. The names of the suggesters are not known to the meeting, but only to an executive committee of five. Suggestions for this monthly competition are deposited in a box fixed in the gate house, which is cleared every day by the secretary, who dates each communication to allow of their consideration in order of priority. The above scheme is still in operation and the results have been eminently satisfactory.

Theoretically, the giving of a prize is rather too closely allied to the granting of a favor and a payment in the form of a percentage on the saving effected by the invention during a certain period would be a fairer arrangement if it could be carried out, but several difficulties would arise in doing this. Disputes might occur as to the number of articles made with the help of a new device during the period decided upon, and payments would be deferred for a longer time than under the prize system, also a workman who made an improvement when trade was slack would not benefit nearly so much as another whose idea was adopted during a period of prosperity.

Taking these considerations into account, the method of making payments through the medium of prizes appears to be the only one available, and as far as the writer is aware no other has yet been tried.

The examination of the suggestions and the awarding of prizes will require very careful and conscientious handling, if the confidence of the men is to be maintained, and without the latter

ro suggestion system will be successful for any length of time. The matter is, however, purely one for the management to settle. There is no reason why the men should be represented on the committee appointed for this purpose, the position between the parties being that of buyer and seller—that is to say, the workman agrees to surrender his idea for a certain payment from the employer; but it is most important that he should be able to rely upon obtaining fair treatment; it is also desirable, if suggestions are refused, that reasons should be given for so doing.

The committee above mentioned may very well consist of three members, and the most suitable officials for this purpose are the works manager, the chief draughtsman and the shop manager. The competitor will naturally be called in to explain his invention, and it will often be necessary to obtain expert opinion from one or other of the foremen.

Conspicuous notices should be posted in the works giving full details of the payments and prizes offered, and suggestions should be addressed to the works manager through the post. The method of placing locked boxes in the works is not altogether satisfactory, as many workmen do not care to allow their efforts in this direction to be known to their comrades or foremen until success has been assured.

In settling the amount to be given in prizes, the type of product manufactured must be taken into account; where articles are made of a special nature, and of which the design is fully protected by patents, an improvement reducing the cost of manufacture or enhancing the selling value is of much greater worth than would obtain if open competition were encountered. In the latter case the device adopted would very soon become known and taken up by trade competitors, resulting in a reduction of prices; or equally good methods may be discovered by outside firms, thus having a similar effect, therefore unless an idea is good enough to patent, the advantages accruing from it are not likely to remain in force for any considerable period. Mr. Horsnaill believes that a suggestion system, if properly worked, can be made to pay handsomely, and should keep the undertaking adopting it ahead of its competitors, unless they have followed a similar course.

CURRENT NEWS AND NOTES.

PITTSBURG BRANCH I. E. S.—A branch of the Illuminating Engineering Society was organized September 12 at Pittsburg. Mr. G. Brewer Griffin acted as temporary chairman and Mr. J. C. McQueston as temporary secretary. Messrs. Max Harris, C. S. St. John, W. I. Patterson, E. R. Roberts, Ernest Gawthorp, J. S. Lacock, L. H. Schuur and J. A. Leary were appointed a committee on local membership. Permanent organization will be effected next month. Branches of the society have now been formed in four cities, the other three being Boston, Philadelphia and Chicago. In addition, the New York members will shortly organize as a section on the same footing as the other branches, and Slope members of the society intend to organize a section in San Francisco.

A. I. E. E. MEETING.—The 209th meeting of the American Institute of Electrical Engineers will be held in the auditorium of the New York Edison Building, 44 West Twenty-seventh Street, on Friday, September 28, at 8.15 p.m. Dr. Samuel Sheldon, recently elected president of the Institute, will be officially conducted into office at this meeting. Dr. Sheldon will read his inaugural address, entitled "The Work of the Institute." The following papers will be presented: 1. "The Effect of Iron in Distorting Alternating-Current Wave Form," by Professor Frederick Bedell and Elbert B. Tuttle, of the Cornell University, Ithaca, N. Y. 2. "The Current Transformer," by Kenneth L. Curtis, of Leland Stanford, Jr., University, Palo Alto, Cal.

INDIANA TROLLEY MEETING.—The Central Electric Railway Association will hold a fall meeting at Robinson Park, on the line of the Fort Wayne & Wabash Valley Traction Company, on September 27. The most important technical item will be presented by Mr. C. R. McKay, who will read a paper on "Lightning Arresters," to be followed by a general discussion. President Spring has appointed a special committee on lightning protection. The object of the selection of this committee is to prepare a suitable set of instructions and forms for obtaining detailed data from interurban companies, of the experience with lightning and similar disturbances, on the various lines and under the varying conditions existing. He thinks this committee will be able, with the proper forms, to procure data covering a large number of conditions and practically all of the several types of protective apparatus, as well as comparative observations on lines of varied voltage, frequencies, lengths, locations, topographies and constructions.

TOPOGRAPHIC SURVEYS are being made in many parts of the country by the United States Geological Survey. When the maps resulting from these surveys are finally engraved and published they will be for sale at the mere cost of paper and printing—5 cents a copy. Many of these surveys are made in cooperation with State officials, the expenses of the work being shared alike by Federal and State Governments. In all such cases the technical part of the work is directed by the head of the Federal Survey, while the interests of the particular areas surveyed are looked after by the State officials. Such work is already developing or well advanced in Louisiana, Mississippi, Virginia and Tennessee. It is believed that these maps will be of great value to the people of the State in the development of its natural resources. They form a basis for the development of the forests and the good roads of the State, and are of great use to all public officials engaged in building reservoirs and waterworks, as well as to engineers and surveyors who wish to lay out and construct electric roads, transmission lines, etc.

TELEPHONY IN CANADA.—The meeting of the independent telephonists of Canada at Toronto elected the following officers: President, Alph. Hoover, Green River, Ont.; vice-president, F. D. MacKay, Toronto; secretary-treasurer, A. F. Wilson, Markham, Ont. Executive Committee—T. F. Demers, M. D., Levis, Que.; W. Doan, M. D., Harrietsville, Ont.; C. J. Thornton, Kirby, Ont.; Dr. Ochs, Hespeler, Ont.; Richard Vigars, Port Arthur, Ont.; E. Hart, M. D., Brantford, Ont.; Levi Moyer, Beamsville, Ont.; F. Dagger, Toronto; C. Skinner, Sherbrooke. The convention was actively participated in by telephonists from the United States and adopted a resolution that it was "not in the interests of independent telephone companies to contribute to the campaign funds of the Bell Telephone Company by buying equipment from the Kelloggs, of Chicago, or the Northern Electric Company," which it was claimed were subsidiary companies to the Bell. The proceedings consisted almost entirely of attacks on the Bell system and developed no points of technical interest, except the expression of a desire for standardized apparatus. Steps were also taken to adopt a uniform "maple leaf" shield for independent exchange signs.

OPPORTUNITIES IN EGYPT are discussed in a most interesting report by Mr. C. M. Pepper, special agent for the Department of Commerce and Labor, Bureau of Manufactures. Attention is called to the industrial renaissance of the country, and details are given as to all branches of trade. He mentions that one alliance of 24 British engineering firms endeavors to cover all requirements in Egypt and the Soudan. Their list includes electric cables. Another European importing firm handles dynamos and engines from England and France. Smaller houses are in the same line of work. A New York concern, the International Engineering Company, has lately entered the field with the object of making a specialty of American machinery. "The prospect for electric installation is a fair one, though Arab villages do not take to electric lighting with such avidity as do many other primitive communities. Besides Alexandria and Cairo, some of the largest towns are the main dependence, as are also the big plantations. Electric railways (trolleys) are being extended, and recently the main suburban line of Alexandria has changed from steam to electric power, in harmony with the tramway system of the city. Telephone and telegraph lines under the State are likely to be materially increased. One of the chief American electrical companies seeks business in Egypt through its European office. The importation of electrical apparatus is valued at $750,000 yearly."

ON INDIAN RAILROADS.—A Government report on the railroads of India shows that no fewer than 648 of the cars are lighted by electricity. The train signal system is well developed, and there are 79 stations provided with instruments for signaling trains automatically between stations, and 180 stations fitted with apparatus for interlocking points and signals.

ENERGY FOR STEEL WORKS.—The Niagara, Lockport & Ontario Power Company is installing a plant at the Lackawanna Steel Company's works, south of Buffalo, and will commence about October 1 delivering 10,000 hp from Niagara River, displacing steam and natural gas to a great extent at the big steel works. It is expected that this delivery will eventually be increased to 20,000 hp. At the opening of these great works a year or two ago, a description was given in these pages of the fine electric plant installed for light and power.

NEW YORK TRAVEL PLANS.—Chief Engineer Rice, of the New York Rapid Transit Commission, has submitted to the plan and scope committee plans for elevated and subway loops between the Brooklyn and Williamsburg bridges. Part of the route, the elevated tracks, would be an upper story upon the present structure in the Bowery and Park Row. It would cost with damages about $3,550,000, and would be made readily removable. The subway plans include a comprehensive system of lines on each side of the East River, to become a part of the general system and to cost $16,000,000.

NEW YORK WAGES.—The New York City Railway Company made last week several advances in wages. Motormen formerly got from $2.10 to $2.50 a day, but will now begin on $2.25 a day and rise to $2.60 a day after five years' service. Conductors who have been receiving from $2 to $2.35 a day will get from $2.15 to $2.45. Mr. Oren Root, Jr., general manager, says the new rates average 35 cents a day higher than those of any other surface traction company in the East. The company has been short-handed and the new scale should attract plenty of the right kind of men from all over the country.

COLER'S CHOLER.—Mr. Bird S. Coler, borough president of Brooklyn, noted for his advocacy of municipal trolleys in Brooklyn, and for his activity in encouraging strife and bitterness over the Coney Island fare dispute, was arrested two or three times in New Jersey recently for breaking the State laws of various kinds, while riding about in an automobile belonging to the city. He is now angry because Controller Metz has refused to pay his private telephone bills, on the ground that his city work requires such service. Controller Metz insists on holding the bills up and says that he pays for his own private telephone and expects Mr. Coler to do the same.

SEATTLE CITY OWNERSHIP.—A special dispatch from Seattle, Wash., of September 13 says: "Municipal ownership of street railways, as represented in a proposal to bond the city of Seattle for $4,272,000, of which $1,172,000 was to be charged against the general funds of the city, and the rest to be an indebtedness against 20 per cent of the gross receipts of the system when in operation, was defeated at a special election yesterday. It was proposed to build a municipal street railway system that would parallel and extend beyond the lines of the Seattle Electric Railway Company, owned by Boston capitalists." Comments on the subject have already appeared in these pages.

WIGWAGS AND WIGWAMS.—The Red Indian is still supposed to maintain his old system of signals, but the wigwag or the tomtom is no longer the only resort of the wigwam. In a little village near Seattle, Wash., lives an old Siwash Indian, who has equipped his wigwam with a telephone. His wigwam is nothing more than bark, gunny sacks and cast-off pieces of sail, surmounted by a lot of flattened old tin cans for a roof. But in spite of the primitive nature of the premises there is a telephone inside. The old warrior is a dealer in wickerware, and when it comes to quoting prices and taking advantage of the ups and downs of the market he is keen to appreciate the value of the telephone and is not above letting other braves use it as a pay station.

AUSTRIAN STATE RADIUM.—The Vienna Imperial Academy of Science has announced the result of its examination of uranium earth from the Joachimsthal State mines in Bohemia, conducted in the Academy's laboratories in Vienna. About 50 tons of earth were subjected to tests and experiments, yielding radium products worth at the present market price more than $200,000. Dr. Hartinger conducted the investigation. The products thus obtained will not be sold, but will remain the property of the Academy and be used for further scientific research. The Austrian Ministry of Agriculture has decided to build its own laboratories at Joachimsthal for the production of radium salts. It is also proposed to exploit the healing properties of radium by establishing a health resort there and using the springs in the mines there for curative purposes, both in baths and for drinking.

THE BROOKLYN INSTITUTE.—An admirable prospectus for 1906-7 has been issued by the Brooklyn Institute of Arts and Sciences, an institution which under the fostering care of Prof. Franklin W. Hooper has of late years been lifted into a very prominent place among the centers of culture and education in the Borough of Brooklyn. The prospectus enumerates no fewer than 475 addresses, lectures, exhibitions, meetings, concerts, etc., that are available to the membership this winter, and what may be termed the faculty comprises the best special talent in each field. Dr. S. Sheldon is president of the department of electricity, which offers a course of ten excellent lectures by well-known experts and authorities; in addition to which are separate courses of illustrated lectures by Prof. C. L. Harrington, M.A., on the general subject of "Electricity."

ARTIFICIAL GRAPHITE.—The figures of the annual report of the United States Geological Survey show that the production of artificial graphite has steadily increased since its introduction in 1897. The quantity of this variety of graphite manufactured in 1905 amounted to 4,591,550 lb., valued at $313,980, the largest quantity produced in any year since its introduction. This is an increase of 1,343,550 lb. in quantity and of $96,190 in value as compared with 1904. The average price per pound received for the year 1905 was 6.38 cents, bringing the price back to about that of 1903. The use of the artificial product is being rapidly extended, and it now comes into competition with the natural graphite in many lines of manufacture, especially in the electrical industries. Mr. Acheson has announced recently important advances in this field that he has made his own.

SOUTH AMERICAN CABLE.—The Commercial Cable Company has given notice of the opening of a new cable route to South America. The new line affords accelerated service and the most direct line to Pernambuco, Para, Bahia, Rio de Janeiro, Santos, Montevideo, Buenos Ayres and other places in South America. The new line is laid between the Azores and the Cape Verde Islands and was placed in operation September 15. Formerly cablegrams from this country were sent to South America through the Azores station to Lisbon and thence to the Cape Verde Islands, from which station they were transmitted direct to South American points. Traffic to South Africa also goes from Lisbon through the Cape Verde Islands, and cablegrams to South American points were often delayed through congestion at this central station. The new line cuts out the Lisbon station for the South American service, affording an almost direct line for South American cablegrams.

HUDSON RIVER TUNNELS.—The Pennsylvania Railroad is making splendid progress on its Hudson River tunnels through which the electric trains will run; in fact the work is said to be almost a year ahead of schedule. On September 12 officials of the O'Rourke Construction Company and their guests made the first trip through the north tube of the tunnel. The members of the party walked through the tube, and it took them three-quarters of an hour to pass from the Jersey to the New York shore. The tube was found to be satisfactory in every particular. Charles M. Jacobs, chief engineer of the construction company, was the first person to step through the two shields, which, starting from opposite sides of the river, met within a few feet of its center. Mr. John F. O'Rourke, presi-

dent of the construction company, followed him, and Mr. Alfred Noble, chief engineer of the Pennsylvania tunnels under the East River, came next. The trip was an official inspection by the engineers in charge of the work.

THE NORTH MAGNETIC POLE.—Advices from Seattle of September 16 state that Captain Amundsen, who made the Northwest Passage, and is believed to have located the north magnetic pole, reached there on the steamship *Saratega* from Nome. A committee of the Chamber of Commerce and the local Norwegian societies met him. Owing to his desire to reach the Government observatory at Sitka to complete his magnetic observations, Captain Amundsen sailed for Sitka on the steamer *Jefferson* a short time after his arrival. "My observations extend over a period of three years, and it will take three years to calculate them," he said. "Until that time it is utterly impossible to say positively what I have accomplished by my observations. I believe, however, that I have found the north magnetic pole. I cannot say as yet whether it is a shifting point or extends over a large area. We also took careful observations of the aurora borealis, and I believe that my observations will show that this phenomenon has a marked effect on the compass. Our zoological and ethnological collection is fairly complete."

THE NEW YORK ELECTRICAL SOCIETY will open its season for 1906-1907 with an extremely interesting meeting, introducing to the electrical public one of the most notable inventions of recent years, the Cahill dynamophone and telharmonium system, by means of which exquisite music is obtained directly from electric currents and can be distributed to thousands of subscribers from one plant. The apparatus has already been broadly described in the technical press, and on Wednesday evening, September 26, at 8 o'clock, the New York Electrical Society will hold its meeting at the plant, first of its kind in the world, just installed at Broadway and Thirty-ninth Street. Mr. Oscar T. Crosby, the well-known electrical engineer, who is associated with Dr. Thaddeus Cahill in the enterprise, will deliver an address on the subject of the apparatus, and then an excellent programme of music of all kinds will be presented, some of the numbers being accompanied by vocal artists, demonstrating very fully the capacity of this extraordinary system. The new president, Mr. George Herbert Condict, will be in the chair, and each member will be at liberty to bring one lady on presentation of the card of admission.

THE WIRELESS CONFERENCE.—Discussing the October conference at Berlin, the New York *Evening Post* says: "At the international conference on wireless telegraphy, to be held in Berlin next month, a number of important questions will be brought forward for discussion. This new form of communication has from the first been seized upon by the army and navy authorities as being in their especial province. Particularly has this been true in our country, where it has been argued that only the Government should be allowed to operate wireless stations, especially along the coast. The commercial uses of wireless telegraphy have but slowly developed. If it should be found feasible to establish a commercial service between, say, Chicago and New York, the governmental attitude would have to undergo a change. The Electrical World has made some excellent suggestions for the Berlin conference. It is indubitably correct in its contention that all vessels equipped with the wireless should be made to receive messages from any other vessel, no matter what the flag or the system. The chief trouble is the language. How is a Spanish ship to communicate with a German except by spelling out the letters of the international signal code?"

TELEPHONY IN MANITOBA.—Premier Hoblin, of Manitoba, in a recent publication said that Manitoba had offered the Bell people 105 cents for every dollar's worth of their property in this province. This was not permitted by the Dominion Government, Hon. A. B. Aylesworth acting on behalf of the Bell Company, therefore the Bell system will be appropriated if possible. "Anyway, this province will own its own telephone system. At the next municipal elections in December a non-partisan plebiscite will be taken throughout the province and the feeling of every voter in the province will thus be tested on the subject. After the system has been legalized it will be left to the option of the Council of each municipality to say whether that district will use it. It will be purely local option. It will be a first-class system, under the management of a commission of business men and experts and with equal brains and an effective administration the government may be able to run it at less than a quarter the cost to the user than charged by the Bell. The cost will not be anything. It will be floated and financed in such a way that no man will feel it to the extent of one cent, and maintenance will be borne by those who use the service."

PENNSYLVANIA INDEPENDENTS.—The third annual convention of the Pennsylvania State Independent Telephone Association was held at Allentown, Pa., on September 11 with 100 delegates in attendance. Mr. C. W. Kline, of Hazleton, the president, said, in his annual report, that in number of telephones the independents are now in the lead, both in the State and in the United States. In Pennsylvania, he said, there are approximately 150,000 independent telephones. "The field of the independent telephone men," Mr. Kline declared, "is to make the telephone a poor man's necessity instead of a rich man's luxury." The visitors spent the afternoon as guests of Charles West, superintendent of the Consolidated Companies of Pennsylvania, testing the new "girlless" or automatic telephone system, lately installed. During the proceedings Mr. West prophesied easy talking across the continent. He is the inventor of a "phantom duplex" system, whereby two conversations can be carried on over the same wire. Dr. Frank Hart, of Pittsburg, spoke on "Development of Long-Distance Business," and A. J. Ulrich, of Philadelphia, on "Operating Methods." These officers of the State Association were elected: President, Charles West, Allentown; vice-presidents, E. D. Schade, Johnstown, and J. G. Splane, Pittsburg; secretary, H. E. Bradley, Philadelphia; treasurer, C. E. Wilson, Philadelphia. The convention closed with a banquet at which the principal speakers were Martin W. Littleton, of New York; ex-Governor Bunn, of Philadelphia, and John H. Rothermel, of Reading, candidate for Congress in the Berks-Lehigh district.

STREET RAILWAY TALKS.—Under this caption President Andrews, of the Cleveland Electric Railway Company is running a series of effective advertisements in the local papers, to offset Tom Johnson's windy talk. The following, No. 17, is an example, excepting the style or type: "Do you want Chicago conditions? This little story happens to be true. The day after E. F. Dunne was elected mayor of Chicago, upon a platform of "immediate municipal ownership," three men boarded a street car on their way to work. The conductor asked for their fares. They refused to pay. When the conductor demanded their reason for refusing they replied: 'We've got municipal ownership now. Mayor Dunne's elected. We own the street cars as much as anybody else does. We don't have to pay fares any more.' When the conductor attempted to expostulate with them they interrupted, saying: 'No, you can't fool us. We know we don't have to pay any more. Mayor Dunne's speech-makers told us so!' To make a long story short, it ended in a riot in which the conductor was pummeled and thrown off the car. You may remember that about the same thing happened in Cleveland the day after Mayor Johnson's first election—the passenger thinking he had the right to ride for three cents. In both cases the people had been fooled into believing that they would get something in return for their votes. The present situation in Cleveland is almost identical. Certain men are promising you three-cent fares, eight years from now, with absolutely no certainty that they can carry out their promises. If they succeed in pulling the wool over your eyes, as was done in Chicago, you will be a sadder but wiser man eight years from now. We don't ask you to wait eight years, or eight days. We will give you 3½-cent fares the very day you extend our rights to serve you to such a length of time that we can afford to do it."

How the New York Edison Company Uses Its Own Electricity.

PROBABLY no other electric light company in this country, or for that matter in the world, shows as much faith in its own product as does the New York Edison Company. In an electrical sense it is both physician and patient; for it not only prescribes electricity, but partakes freely of its own remedy. Nor is this done in secret or in small doses. Huge electric signs

FIG. 1.—GENERAL OFFICES, INSPECTION AND CONTRACT DEPARTMENT, DUANE STREET.

proclaim it, half a hundred electric automobiles show it and large electrically-driven shops prove it. Few central station men have any idea of the extent of the application of electricity made by the New York Edison Company for its own uses, and for that reason what follows will doubtless be of more than passing interest.

Besides the general offices at 55 Duane Street, the company maintains branch offices with contract and inspection departments at 115 Delancey Street, 30 West Thirty-second Street, 27 East One Hundred and Twenty-fifth Street and 634 East One Hundred and Forty-ninth Street. In each of these offices an electrical exhibit is maintained in the show windows and on a large table in front of the office proper is a complete set of the com-

FIG. 2.—ELECTRIC KITCHEN, DUANE STREET.

pany's electrical literature, together with copies of the electrical publications. Needless to say, every district office has its electrical sign; the interior is brilliantly illuminated by electric lamps and where conditions permit a motor application forms part of the display.

At the general offices on Duane Street electricity is used to a considerable extent. Approaching from any direction one is confronted with an electric sign. Entering the building the whole electrical equipment of the Duane Street station is open to view. The elevators that whisk one to the general offices on the seventh floor are electrically driven, and electric arc lamps, electric signs, electric fans, etc., are everywhere apparent. In the general office

FIG. 3.—BRANCH OFFICE ON ONE HUNDRED AND TWENTY-FIFTH STREET.

routine pencils are sharpened by electrically-driven pencil sharpeners. Instead of using stenographers, correspondence of all kinds is dictated to electrically-driven phonographs; some placed in the top drawer of the desks, others on portable carriages taken from desk to desk. When the records are complete the wax cylinders are taken to the correspondence room, where they are placed in a similar electrically-driven machine, a reproducer instead of a recorder attached, and the letter typewritten by a typist. A large number of phonographs are employed and a corps of typists. It might appear at first sight that this application of electricity were more ostentatious than useful; but a little

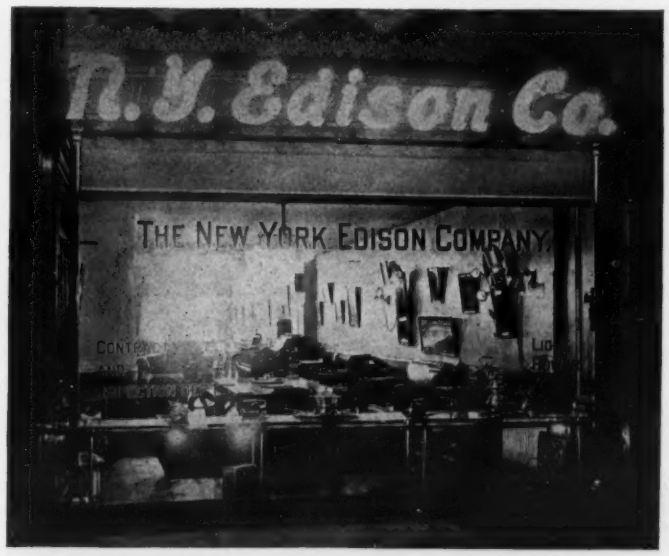


FIG. 4.—BRANCH OFFICE ON THIRTY-SECOND STREET.

thought shows that such is not the case. Neglecting entirely the convenience and precision of the arrangement whereby one may dictate whenever necessary with the assurance of having the letter written as dictated, it has been found that a typist can turn out many times more work with this arrangement than by the ordinary methods of dictation. Moreover, a typist and not a stenographer is required reducing the cost of labor somewhat.

On the top floor of the building an interesting electric kitchen

has been in daily operation for a number of years. Here a luncheon is prepared for the officers of the company. The equipment comprises all kinds of electrical cooking devices; the coffee beans are ground in an electrically-driven coffee grinder; the water is pumped by an electrically-driven pump, and the prepared dishes are sent down to the dining-room on the floor below in an electrically-operated dumb waiter equipped with

FIG. 5.—FORMER BRANCH OFFICE ON GRAND STREET.

electric indicator and signal systems. The number of persons served daily averages about 20.

A handsome exhibition room will be established in the addition now building on the Elm Street side of the Duane Street station. In this room will be shown an electrically-driven refrigerator plant for circulating iced water throughout the building; an electrically-driven pneumatic carrier system also for use in the building and an electrically-operated vacuum cleaning system.

FIG. 6.—BRANCH OFFICE ON ONE HUNDRED AND FORTY-NINTH STREET.

These various systems, it will be noted, are installed as necessary adjuncts to the building and will be in continuous operation. By installing them in a special room opening on Elm Street they also serve as working exhibits showing three very useful applications of electric motors to office building equipments.

During the past year the number of electric signs in New York has increased over 60 per cent, and it is only natural that an electric light company which displays such energy is soliciting this particular class of lighting business should itself be a large user of this kind of advertising; for if an electric sign serves as a means to increase the sale of certain commodities, it will also serve to increase the sale of electrical energy. Anyone traveling through the frequented thoroughfares of New York City will, therefore, find at various points of vantage large electric signs maintained by the New York Edison Company for its own uses. Electric signs are also installed on nearly all of the generating stations, attracting the attention of travelers by rail or by boat. Every train entering New York City over the New York Central and New Haven roads passes very closely to the Bronx station of the New York Edison Company on the roof of which is a large electric sign shown in one of the engravings. Traveling by boat up or down the Hudson River the huge sign at Shadyside, N. J., is visible for miles. The sign is also visible to persons on the New York bank of the river for a great distance. A description of this immense sign was published in the June 2 number of the Electrical World. Persons entering or leaving New York City by way of the numerous steamboat lines plying Long Island Sound may see on the West bank of the East River the two large signs on the Waterside station. At the corner of Sixty-fifth

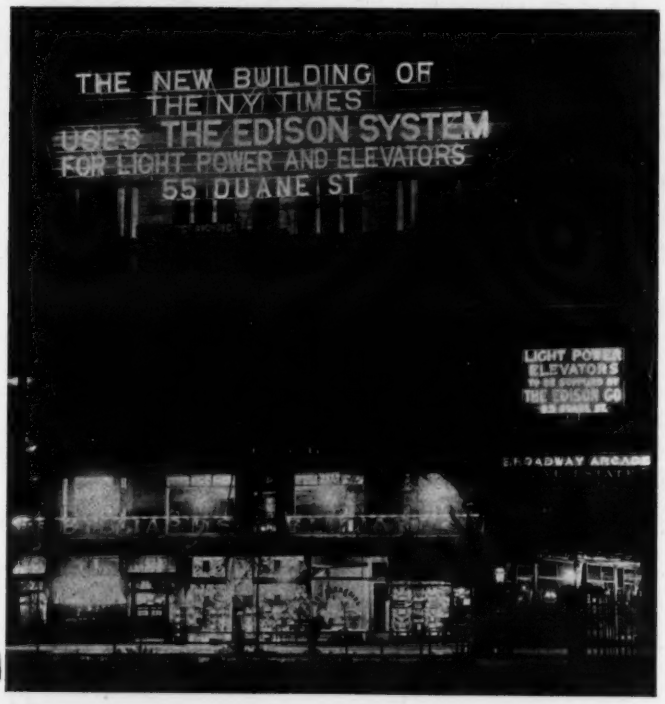


FIG. 7.—EDISON SIGNS AT BROADWAY AND SIXTY-FIFTH STREET.

Street and Broadway is a large electric sign somewhat similar to that shown in the engraving. Since the photograph was taken, this sign has been changed so that a talking sign intermittently spells out the names of large users of Edison service. On every new building of importance which is to be connected to the Edison mains an electric sign is erected similar to the one shown on the right in Fig. 7 reading "Light, Power, Elevators, to be supplied by the Edison Co., 55 Duane Street." Different signs are, of course, used for the different classes of service. At present there are sixteen signs in use, calling for 10,654 incandescent lamps and at 10 cents per kilowatt-hour these signs consume $101.41 worth of energy per night, or cost approximately $37,000 per year to operate.

Of the branch offices that at 27 East One Hundred and Twenty-fifth Street is worthy of special mention. An exterior view of this office by night is shown in Fig. 6. The interior color scheme is green and white, and although the furnishings are not yet complete the whole arrangements betrays much thought and taste. The lighting is particularly pleasing and the perfect distribution of the light is apparent from the engraving. Not an electric lamp is visible, diffused reflection being depended on entirely. The building is a one-story structure with a number of skylights in the roof giving an abundance of ventilation and natural light. The office proper is on a sort of mezzanine floor

as shown. On the walls of what might be termed the reception room are numerous framed photographs showing interesting application of electricity and many buildings which are connected to the Edison mains. In an ornamental hearth built in the wall is an electric radiator. Easy chairs are provided and on the large table in the center is a quantity of electrical literature. The front of the building besides having the usual plate glass windows is provided with a beautiful stained glass window of special design showing some of the "Edison People" created by the Edison Company and familiar to every user of electricity in New York

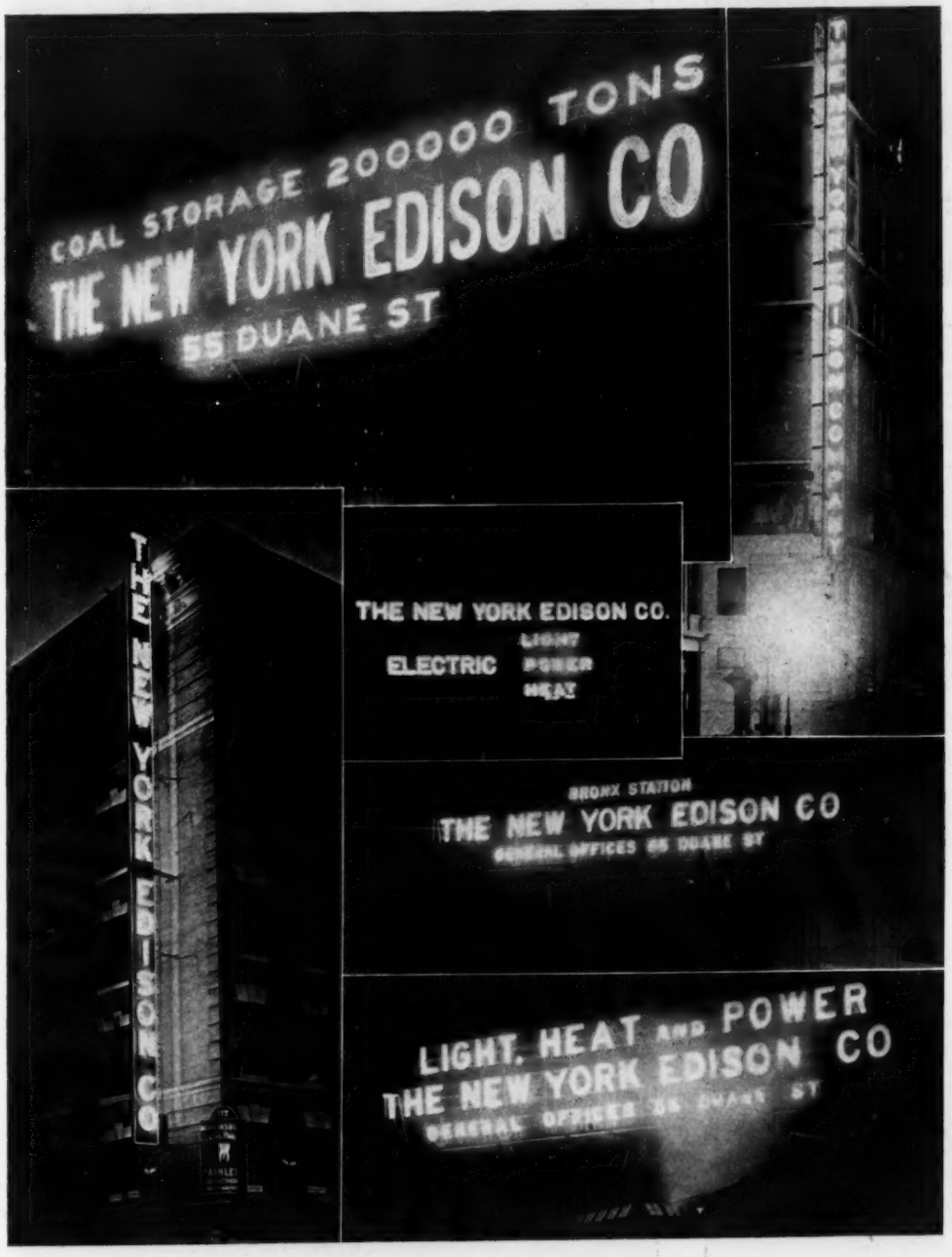

COAL STORAGE 200000 TONS
THE NEW YORK EDISON CO
55 DUANE ST
THE NEW YORK EDISON CO.
ELECTRIC LIGHT POWER HEAT
BRONX STATION
THE NEW YORK EDISON CO
LIGHT, HEAT AND POWER
THE NEW YORK EDISON CO

FIG. 8.—A GROUP OF EDISON SIGNS BY NIGHT.

City. Standing on what represents the earth are five of these Edison characters gazing in rapt amazement at the blazing letters in the sky spelling "The New York Edison Company." In the panel at the right is an Edison damsel using an electrically-operated sewing machine, and in the panel at the left is another Edison maid using an electric flatiron. In the panels above are Edison characters carrying incandescent lamps on trays, the center panel towards which they face bearing the familiar legend, "at your service." This stained glass window is lighted from the rear by two rows of incandescent lamps in Frink reflectors, which give to it a strikingly beautiful effect that has called forth much comment. Illustrations showing the other branch offices are given herewith; the Grand Street office, however, having been since moved to Delancey Street.

The New York Edison Company uses electric automobiles exclusively. Not solely because they are electric, but because after years of experience it finds that they are much cheaper to operate and are more reliable than any other type of automobile on the market. In all there are 51 automobiles in use, classified as follows: Three surreys for general passenger service; one paymaster's wagon for use in paying employes at the various stations, sub-stations and offices, as well as gangs of workmen on the street; five tonneaus for use of the superintendents; thirty-four delivery wagons for carrying general supplies and for delivering arc and incandescent lamps, and eight trucks for carting heavy supplies, underground material, and used also for drawing cables through the underground conduit in the streets, the trucks being provided with electric winches. The number of persons regularly employed in the automobile service is 95, exclusive of the gangs which accompany the trucks and erecting wagons.

A general view of the automobile station and repair shop on Forty-first Street east of First Avenue is shown in Fig. 11. Here the automobiles receive a general inspection and the batteries a close examination and test every night. A very complete record is kept of every automobile and its equipment. Each vehicle has a job number and everything done to the vehicle in the way of repairs, etc., is charged against it, so that by this means the company knows exactly what each vehicle costs. Daily records are kept of the mileage traveled, condition of battery and tires, length of charge and the amount of repairs, and this record is complete for each machine from the time it was bought. A small repair department is maintained, but most of the heavy work is done in the general repair shops of the company close by. A view of the automobile repair shop showing the character of the work done is given in Fig. 9.

While it is possible to recharge batteries at any of the company's stations, or for that matter from any of the lamp posts, this is not done without permission from the manager of the automobile shops. Every one of the 51 automobiles is fully charged and in condition for service every morning, and should any accident happen, the driver is required to telephone to the station for instructions. If trouble is experienced with the battery the daily record is referred to and by this means the manager can ascertain if the battery is run down or if the trouble is due to some other cause. If the latter is the case a man is sent immediately to remedy the trouble. If other repairs are needed the emergency repair wagon is sent out, and if the repairs are such that they cannot be made on the street another vehicle is sent out, the crew transferred and the journey continued.

It is interesting to note the various uses to which the automobiles are put. There are seventeen 1,000-lb. wagons, twelve of which are used for delivering incandescent lamps to customers throughout the city. These wagons, one of which is shown herewith, usually carry from 1,000 to 3,000 incandescent lamps of all sizes and types. The lamps are delivered by boys in uniform who receive in return the old lamps. The wagons go over the route daily and some make periodical trips from one end of

the city to the other, renewing incandescent lamps whether requested to do so or not. The remaining five wagons are used by the meter department and carry watt-hour meters and the necessary material to connect these to the mains.

There are also seventeen 2,000-lb. wagons in use, one of which is a high-speed vehicle for night emergency work covering the territory from Bowling Green to Harlem and from the East River to the North River. The wagons carry a repair gang and

FIG. 9.—AUTOMOBILE REPAIR SHOP.

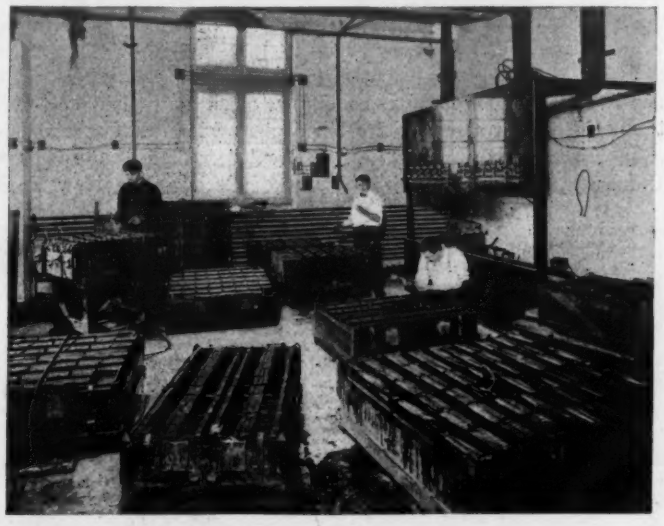


FIG. 10.—BATTERY ROOM, AUTOMOBILE SHOP.

FIG. 11.—GENERAL VIEW OF AUTOMOBILE SHOP.

FIG. 12.—INCANDESCENT LAMP DELIVERY WAGON.

FIG. 13.—ARC LAMP AND ELECTRIC SIGN WAGON.

complete emergency supplies and look after all emergency work, such as burn-outs, break-downs, etc. Six of the wagons are used by the arc lamp department for erecting arc lamps, fixtures, etc., and for installing electric signs. An erecting gang accompanies each wagon. The work is laid out each morning by the foreman. The wagons carry arc lamps, globes, shades and the necessary paraphernalia for erecting lamps and signs. The gang consists of five men and a foreman.

Three of the 2,000-lb. wagons are used by the underground department for furnishing supplies to repair gangs at work on the

FIG. 14.—ARC LAMP ERECTING TRUCK.

streets. These are what might be termed traveling supply wagons and carry solder, connectors, sleeves, tape, etc., for all new work. One wagon is used for collecting and delivering storeroom supplies from one storeroom to another. Three of the wagons are used by the transportation department for collecting freight at the various steamboat and railroad depots and delivering it to the various storerooms throughout the city.

There are three three-ton trucks, one of which is used for transporting heavy freight and for general delivery work. The other two are used by the arc lamp department for erecting city lamp posts, etc. These trucks carry a gang of five men and a foreman, besides the iron posts and the erecting material. Portable electric drills form part of the equipment and these are used

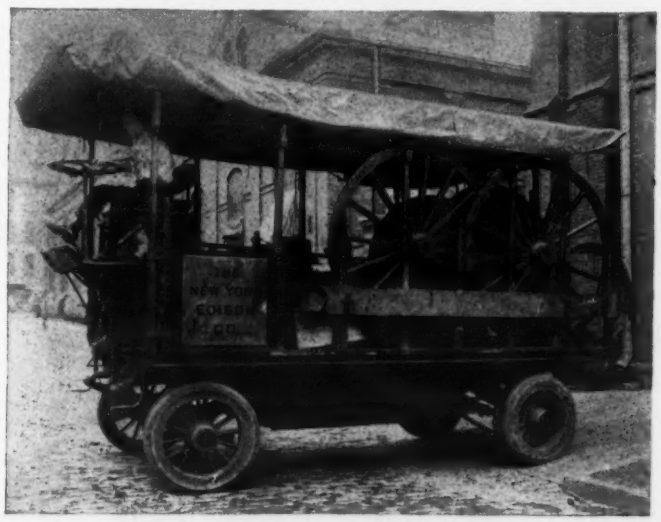


FIG. 15.—HEAVY TRUCK USED FOR UNDERGROUND WORK.

for boring the necessary holes in the various parts of the "Bishop's Crook" poles so that they may be securely joined together.

Five five-ton trucks are used for hauling heavy supplies and carting cables, reels, etc., throughout the city. Each of these trucks is equipped with an electric winch which is used for drawing the cables in the underground street conduits. The erecting gang which accompanies each of the trucks consists of eight men and a foreman. These large trucks are also used during the winter months in thawing out frozen water pipes. By this means it is not necessary to tap any feeders, and frozen water pipes may also be thawed out where there are no electric supply mains at all. Pictures of these various trucks are given herewith.

Fig. 17 shows how the New York Edison Company brings in its supply of incandescent lamps from the lamp factory of the General Electric Company at Harrison, N. J. The truck shown carries 45,000 incandescent lamps and the journey to and

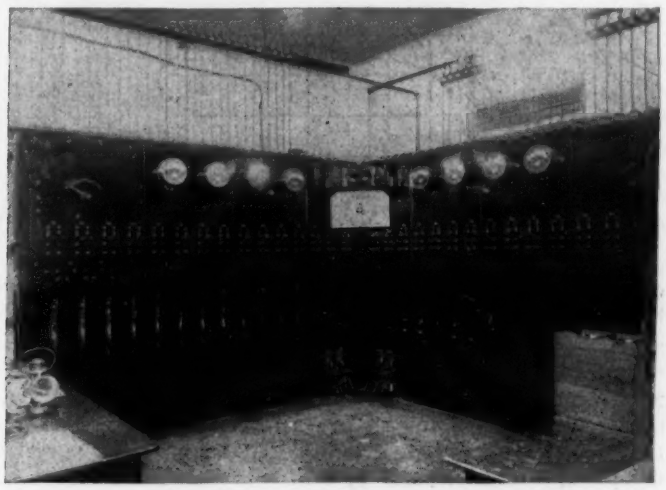


FIG. 16.—AUTOMOBILE CHARGING SWITCHBOARD.

fro requires half a day. Were it not for this method of transporting lamps the question of keeping a sufficient supply on hand would be a very perplexing one. The trip from New York to Harrison and return is made on an average of five times a week.

The charging switchboard at the automobile station is shown in Fig. 16. There are two of these boards each equipped with 30 charging plugs. Each panel is equipped with a double-pole, double-throw switch and rheostat. Readings of the ammeter are taken every hour. The energy is supplied from the Waterside station at 220 volts. This is brought in on the three-wire system so that one board is connected on the negative side and the other board on the positive side of the system.

In the photographic department maintained by the company

FIG. 17.—TRUCKING LAMPS FROM THE GENERAL ELECTRIC FACTORY

on Pearl Street electricity is used in the developing room, and electric fans are used for drying the plates. Mercury vapor arc lamps are used for printing and enlarging. The company has a very complete machine and repair shop at Forty-first Street and First Avenue, a description of which will be published in a subsequent issue.

Characteristic Performance of Polyphase Magnets.

By D. L. Lindquist.

In an article entitled "Polyphase Magnets," which was printed in the issue of the Electrical World for July 21, no consideration was given to the ohmic resistance of the coil. The reason for this was that the coil resistance in general is of very little influence and can be made as low as one may wish.

The iron losses are naturally of the most influence as they

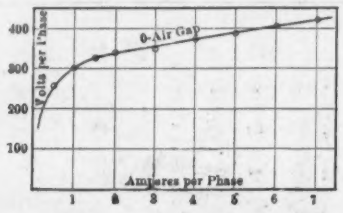


FIG. 1.—TEST OF MAGNET WITH PAPER BETWEEN LAMINATIONS.

cannot be decreased as easily as is the case with the I^2R losses in the coil. In fact, all that can be done is to use the best possible iron in the core and reduce the eddy currents to a minimum. Fig. 1 shows the saturation curve for a magnet with paper insulation between laminations, 500 turns of No. 19 B & S copper in each coil, and slightly smaller iron section than the two-phase magnet already described. At 330 volts and 40 cycles, the power consumption is 55 watts per phase, and the power factor is 0.098. Fig. 16 shows this magnet used for releasing a regular hand brake. This magnet is enclosed in an air-tight housing without oil and is able to hold a load of about 550 lbs. continuously without undue heating.

It is instructive to investigate the influence exerted by the coil resistance and also the external resistance. The heating of the coil being proportional to the losses, the higher the resistance the more will be the heating.

Referring to Fig. 2, $O\ I$ is the total current, $O\ E$ the inductive e.m.f., $E\ E_1$ the voltage drop in the coil resistance, $O\ E_1$

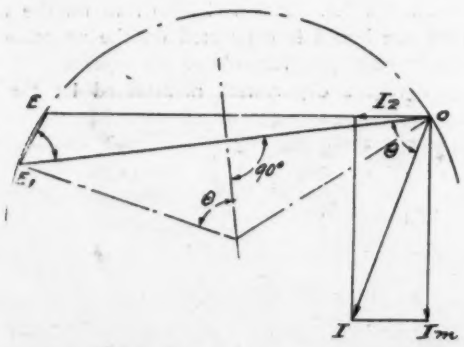


FIG. 2.—GENERAL DIAGRAM OF PHASE RELATIONS.

the applied e.m.f. and cos θ the power factor. Therefore, the correction to be applied in the formula previously deduced is the substitution for the line voltage $O\ E_1$ the inductive voltage $O\ E$.

A practical example will probably give a better illustration and reference is made, therefore, to the curves of Fig. 3. Suppose there is used an impressed e.m.f. of 220 volts with zero air gap. Then the total current = 2.45 amp. per phase, losses per phase = 115 watts, power factor = cos θ = 0.213 (77° — 40′), resistance of 2 coils = 0.78 ohms, and voltage drop in coils = $0.78 \times (2.45) \times 1.05 = 2$ volts. The I^2R losses in the coil = $(2.45)^2 \times 0.78 \times 1.05 = 5$ watts, which are practically negligible compared with the total losses.

Fig. 4 shows the actual diagram for this case. It is seen that there is practically no difference between $E\ O$ and $E_1\ O$. Therefore, at zero air-gap for all practical purposes no correction is necessary in the formula for pull as given in a previous article. (P. 1297, Electrical World, June 23.)

$$P = \lambda \frac{A\ E\ I}{C_s 4.44 f 10^{-8} \{ A + C_s [f(A)] \} 8\pi 981{,}000} \qquad (1)$$

From Fig. 3 it is seen that with a ¼-inch air-gap, the total

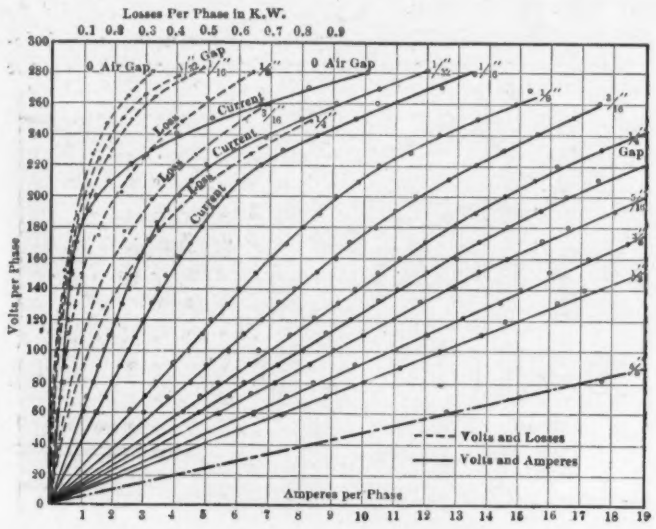

Losses Per Phase in K.W.
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9
Volts per Phase
0 Air Gap
Gap
Loss
Current
Amperes per Phase
Volts and Losses
Volts and Amperes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

FIG. 3.—TEST OF TWO-PHASE MAGNET SUPPLIED WITH TWO-PHASE CURRENT.

current = 16.5 amp., losses per phase = 570 watts, power factor, cos θ = 0.156 (81°), voltage drop in coils = 13.5 volts, and I^2R losses per phase = 220 watts.

It is seen that in this case the coil resistance has considerable

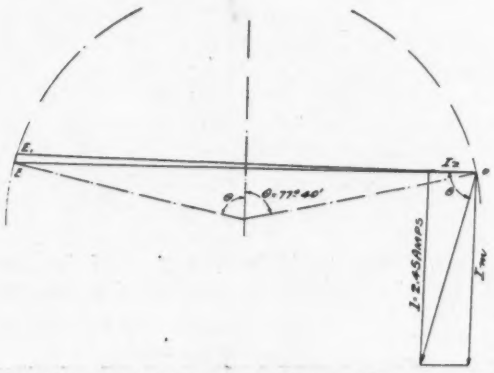


FIG. 4.—ACTUAL DIAGRAM FOR MAGNET WITHOUT SERIES RESISTANCE AT ZERO AIR-GAP.

influence on the losses and the consequent heating, but as this kind of magnet is not intended to stay in circuit unless with zero air-gap, and the lifting consumes very little time, the compara-

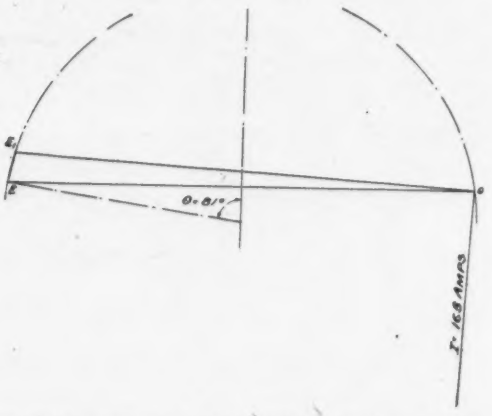


FIG. 5.—DIAGRAM WITHOUT SERIES RESISTANCE AT ¾-IN. AIR-GAP.

tively high losses during lifting give rise to little heating unless the magnet should fail to lift and the current be left on.

Fig. 5 represents the diagram for this case. Even in this

case there is very little difference between $O\,E$ and $O\,E_1$; therefore, the coil resistance has practically no influence on the pull, so that no correction in formula (1) is necessary.

The fact that the pull is practically independent of the coil resistance as long as this resistance is fairly well proportioned

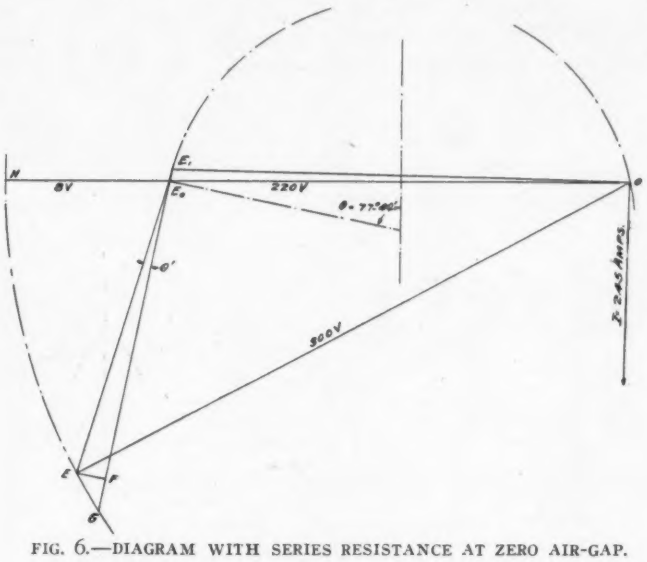


FIG. 6.—DIAGRAM WITH SERIES RESISTANCE AT ZERO AIR-GAP.

is of very great advantage for several reasons. When winding the coils for a magnet of this kind to give a certain pull, no definite size of wire is necessary—merely the right number of turns—and furthermore the temperature of the coil has no influence on the pull. Of course, the coil resistance can be increased to such a value that it has a great deal of influence on the pull, but then the coil is entirely out of proportion, and there is no necessity of using as small a wire as with direct-current magnets because only a small number of turns is necessary.

It is well at this point to consider the effect of placing an external resistance in series with the magnet coils. Assume the same case as shown in Fig. 4, but with the line e.m.f. at 300 volts, and insert resistance in series with the magnet coils in order to obtain the same holding pull as when the magnet was energized with 220 volts without resistance in series.

Referring to Fig. 6, $E_1\,O$ represents the induced voltage and

FIG. 7.—DIAGRAM WITH SERIES RESISTANCE AT ¼-IN. AIR-GAP.

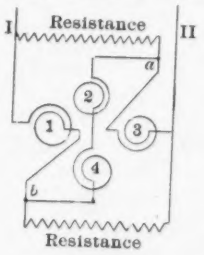


FIG. 8.—CONNECTION DIAGRAM FOR POLYPHASE MAGNET ON SINGLE-PHASE CIRCUIT.

FIG. 9.—PHASE RELATIONS IN POLYPHASE MAGNET ON SINGLE-PHASE CIRCUIT.

$E_0\,O$ the terminal voltage on the magnet coil. $E_0\,G$ parallel with $I\,O$ would then represent the amount and direction of the voltage drop (164 volts) across a non-inductive resistance; and, assuming the current has the same value as before, 2.45 amp. The total impedance necessary is $\frac{300}{2.45} = 122$. The impedance of the magnet is 90 ohms, so that the amount of resistance of the magnet must be 67 ohms. If, therefore, instead of a non-inductive resistance, an inductance with the same power factor as the magnet had been introduced, the voltage across the inductance in the same direction as $E_0\,O$ would have been represented by $E_0\,H$, and the amount of inductance would be only 33 ohms.

In general, a resistance unit possesses some reaction; suppose the power factor for the impedance is cos Θ^1 and the voltage drop across the impedance is $E_0\,E$, of which the ohmic component is $E_0\,F$ and the inductive component is $E\,F$. The ohmic resistance of this impedance is therefore 59.5 ohms.

Suppose now that, as before, the magnet is required to lift ¼ inch (Fig. 5). If the same resistance is used it would be necessary to have a line voltage $E\,O$ (See Fig. 7) of 1,070 volts; or if the line voltage is the same, the pull will be very small.

From the facts stated above it is clear that in general neither resistance nor inductance of a fixed amount can be used for regulating the voltage on an alternating-current magnet. If inductance or resistance is used for regulating the voltage, it is used in conjunction with a switch for inserting more resistance or inductance after the magnet has lifted.

In all of the diagrams above, the reluctance has been considered constant. In cases where the magnet is energized to such an extent that the magnetization curve deviates considerably from a straight line, it is well to consider the action both

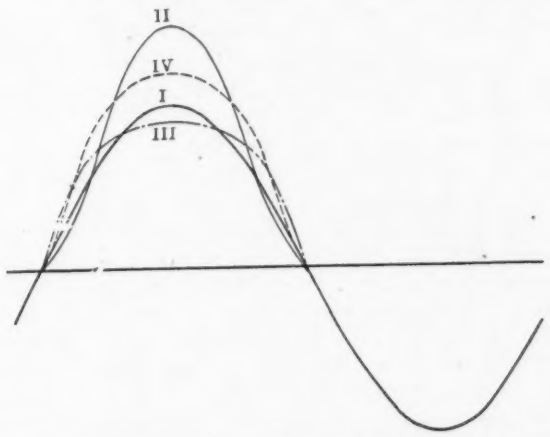


FIG. 10.—EFFECT OF IRREGULARITY OF RELUCTANCE ON THE MAGNET PULL.

without and with resistance in series. If the impressed e.m.f. is of sine shape, the flux (without resistance in series) must also be a sine curve (see curve I, Fig. 10). The current, curve II, is steeper than a sine curve. Suppose now a certain resistance is put in series with the coil and at the same time the line voltage is of such a value that the voltage across the magnet coil is the same as before. The flux in this latter case would then be represented by curve III and the current by curve IV. The effective value of the current IV (measured by ammeter) is less than II, and in general the pull is also less. The flatter the impressed e.m.f the steeper the curve of the magnetic flux, and the more the influence of resistance in series with the coil.

As already mentioned, it is impossible to make a single-coil magnet with constant pull, but with the aid of two external resistances a two-phase magnet can be arranged to give constant pull when energized with single-phase current.

Fig. 8 gives the connection diagram, while Fig. 9 shows the voltage diagram for this case. All coils are wound with the same number of turns, and in order to obtain constant pull, it is necessary that all coils be energized alike or that the voltage across every coil be the same, and also that the e.m.f.s in coils (1) and (3) are in quadrature to the e.m.f.s in coils (2) and (4). The current through coils (1) and (3) must naturally be considerably larger than that through coils (2) and (4) in order to get proper phase relation. The poles of coils (1) and (3) are therefore made shorter in order to have a certain amount of air-gap between them when the plunger is in the up position.

In order to obtain the required starting pull (with the plunger

in the lower position or with the maximum air-gap) only a small amount of resistance is used, and the proper resistance for holding is introduced after the magnet reaches its final position.

In the above treatment consideration has been given exclusively to the pull of a magnet after equilibrium is established in the system. It is equally as important to investigate the instantaneous pull at any time.

The pull of a magnet at any instant is

$$P = \frac{A\,B^2}{8\,\pi\,981{,}000} \qquad (2)$$

If the impressed e.m.f. is of sine shape, after equilibrium is established, then the pull of a single magnet will be

$$P_2 = \lambda\,\frac{A\,B^2_{max}}{8\,\pi\,981{,}000}.\,sin^2\,(\omega\,t) \qquad (3)$$

and the maximum pull

$$P_{max} = \lambda\,\frac{A.\,B^2_{max}}{8\,\pi\,981{,}000} \qquad (4)$$

and the effective pull (see Fig. 11)

$$Peff = P_{max}\,\frac{1}{\pi}\int_0^{\pi}\eta\,sin^2\,(\omega\,t) = \frac{P_{max}}{2} \qquad (5)$$

For a two-phase magnet the total effective pull is twice the effective pull of one phase, that is, it is equal to the maximum pull of one phase.

A single-phase magnet used for lifting, will, therefore, be accelerated in the lifting position during the time between x and y (Fig. 11) and accelerated in the opposite direction during the time between y and z. The amount of vibrating motion depends upon the conditions. The length of vibration motion increases with the load and decreases with the moving mass and decreasing cycles. If the load consist of a spring of some kind, the vibrating motion will be longer than that with a weight as a load. It may be mentioned that for a single-phase magnet acting against a spring, and supplied with current at 25 cycles, the vibrating motion does not in general exceed 1/32-inch, and the possible maximum value is about 1/16-inch. For polyphase magnets with constant pull naturally there is no vibrating motion.

Consider now the action of a single-phase magnet at the instant

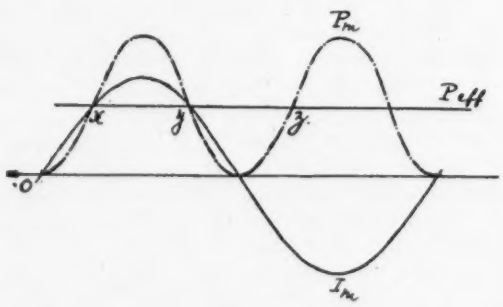


FIG. 11.—RELATION BETWEEN EFFECTIVE PULL AND MAXIMUM PULL.

of closing the circuit and before the system is in equilibrium. The general e.m.f. equation for a circuit having inductance and resistance is

$$e = Ri - L\,\frac{di}{dt} \qquad (7)$$

which is a linear equation of the first order, for which the general solution is

$$i = \frac{1}{L}.\;e^{-\frac{Rt}{L}}\int e^{\frac{Rt}{L}}\,e\,f\,(t)\,dt + C\,e^{-\frac{Rt}{L}} \qquad (8)$$

where e = instantaneous e.m.f.,
i = instantaneous current,
R = resistance in circuit,
L = coefficient of self-induction.

If an e.m.f. of sine shape is applied

$$f\,(t) = E\,sin\,(\omega\,t),$$

and therefore

$$i = \frac{E}{\sqrt{R^2 + L^2\omega^2}}\,sin\,(\omega\,t - arc\,tan\,\frac{L\omega}{R}) + C\,e^{-\frac{Rt}{L}} \qquad (9)$$

If Θ is the angle by which the current lags behind the impressed

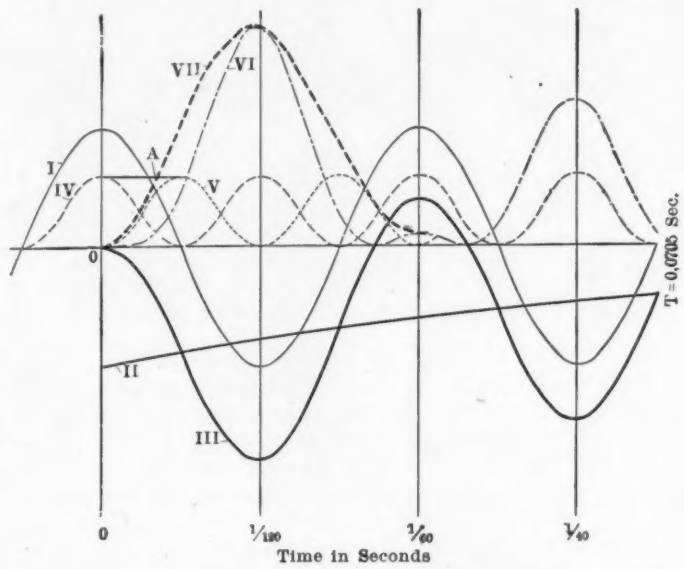


FIG. 12.—VARIATION OF PULL WITH TIME.

e.m.f and Θ' the angle between the instant $\Theta = O$ and the instant of the closing of the circuit (or time t_1) the integration constant C is determined and we have

$$i = I\left\{sin\,\Theta - e^{-\frac{R}{L}(t - t_1)}\,sin\,\Theta'\right\} \qquad (10)$$

$$i_{max} = 2\,I \qquad (11)$$

Consequently the possible instantaneous maximum pull is four times the instantaneous maximum pull after equilibrium has been established and eight times the effective pull.

Consider now the conditions when starting a two-phase magnet. Each phase can be considered as a single-phase magnet, and, as an example, take the alternating-current magnet considered in the previous article (p. 128, Electrical World, July 21st) with 220 turns per coil, with ⅛-inch air-gap and supplied with two-phase currents at 60 cycles and 220 volts.

Referring to formula (10), assume the circuits for both phases are closed at the instant when the current in one phase (No. 1) is a maximum. The current in the other phase (No. 2) is then the same as when equilibrium has been established or

$$i_2 = I\,sin\,\omega\,t = 10.6\,\sqrt{2}\,sin\,\omega\,t \qquad (12)$$

The current in phase (1)

$$i_1 = I\left[cos\,\omega\,t - e^{-\frac{R}{L}\,\omega\,t}\right] \qquad (13)$$

The resistance of the two coils in series $= R = 0.78$ ohms and the coefficient of inductance $= L = \frac{220}{10.6.\;\;2\;\;60} = 0.055$.

Consequently the time constant, $\frac{L}{R} = T$ is

$$T = \frac{0.055}{0.78} = 0.0705 \qquad (14)$$

In Fig. 12 the current i_1 is represented by curve III, which is the resultant of curve I, representing $I \cos \omega t$, and curve II, representing $-IE^{-\frac{R}{L}\omega t}$; curve V represents the magnetic pull due to phase (2) and curve VI the pull of phase (1). The combined pull of both phases is represented by curve VII. From previous curves giving pull at different air-gap, it will

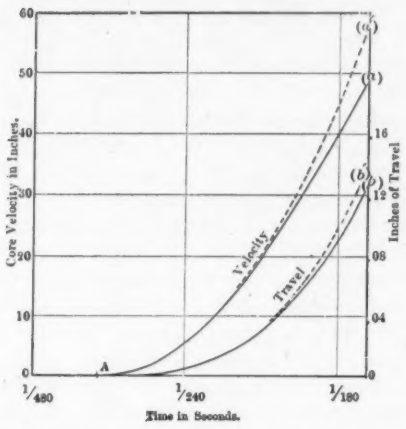


FIG. 13.—VELOCITY AND TRAVEL OF TWO-PHASE MAGNETS.

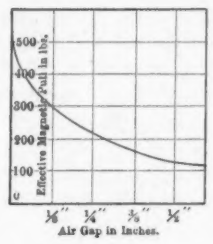


FIG. 14.—PULL OF TWO-PHASE, 60-CYCLE MAGNET.

be noted that the maximum pull of phase (2) = 300 lbs., and from curve VI it will be seen that the maximum pull of phase (1) is 950 lbs., or 3.17 times the pull of phase (2).

Suppose this magnet had to work against a spring with a constant force of 280 lbs. and also to lift its own core weighing 20 lbs., the equation for acceleration is

$$\frac{d^2y}{dt^2} = Q\left(\cos \omega t - e^{-\frac{R}{L}\omega t}\right)^2 + Q \sin^2 \omega t \qquad (15)$$

The results of this differentaial equation are plotted in the curves of Fig. 13. Curve *a* gives the velocity and curve *b* the distance of travel. Curve *a* and *b* are plotted under the assumption that the pull is independent of the air-gap during the travel. As the pull in reality varies during the travel of the magnet (see Fig. 14) the integration under these conditions is made by graphic method, as the pull varies according to an empirical curve. The results are shown in Fig. 13 in the curves *a'* and *b'*. The starting point is at *A* in Figs. 12 and 13. In reality the

FIG. 15.—POLYPHASE MAGNET WITH EXTERNAL DASH-POT.

velocity is even greater than shown by the above formula for the reason that the induction was assumed constant, although this is partly offset by the damping effect of induced secondary currents.

From the above it is seen that an alternating-current magnet has a starting pull depending upon the instant at which the circuit or circuits are closed, and that under the most favorable conditions the maximum starting pull may be four times the maximum pull after equilibrium has been established. This high-starting pull would appear to be very favorable, but as it depends upon the instant the circuit is closed, and this varies, the possible or probable starting pull is not to be counted upon.

FIG. 16.—SELF-CONTAINED POLYPHASE BRAKE MAGNET.

The magnet can naturally only be used to do work where the necessary lifting force is less than the effective pull of the magnet, as otherwise the magnet may not lift; and if the current is left on with the cores apart, the magnet is liable to become overheated.

The high starting pull often causes the magnet to lift very quickly, thereby causing a hard blow when the cores meet. In order to avoid this blow and the consequent noise, it is sometimes necessary to arrange the magnets with dashpots. Figure 15 shows a magnet with external dashpot, and Fig. 16 a magnet where the case is used as a dashpot and the cores themselves are used as pistons; the case is filled with oil, which acts as insulation and also as a cooling medium.

Directed Wireless Telegraphy.

By H. J. Round.

WHILE examining the results recorded in Marconi's paper on the directing of electrical waves, read before the Royal Society of London on March 22d of last year, it was suggested that possibly they were due to a combination of two methods of producing and receiving the electrical waves.

The ordinary method which has been employed for several years consists in the use of a vertical or nearly vertical aerial to send and receive the waves, and this method in transmission obviously gives by symmetry a wave which has the same strength

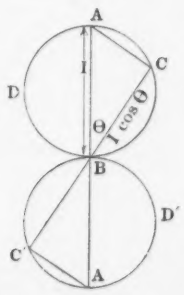


FIG. 1.—POLAR DIAGRAM OF EFFECT DUE TO MAGNETIC FORCES.

at equal distances in any radial direction from the source—and in reception the result is also symmetrical.

In considering the effect of the wave as it passes any given place on the surface, in addition to the vertical displacement currents, which are produced in the medium above the ground, it can be assumed that there are magnetic forces at right angles

to the direction of propagation and parallel to the ground. If it is possible by some method to enclose part of this magnetic force in a receiving circuit, then as the force varies, it will produce a current in the circuit. A closed circuit consisting of one or more turns of wire will enclose the maximum number of magnetic lines when its plane is at right angles to the magnetic field—

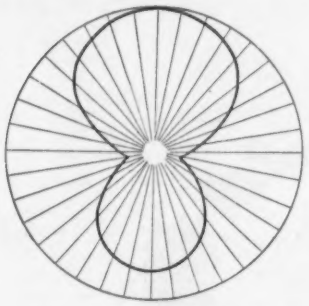


FIG. 2.—COPY OF DIAGRAM FROM MARCONI'S PAPER.

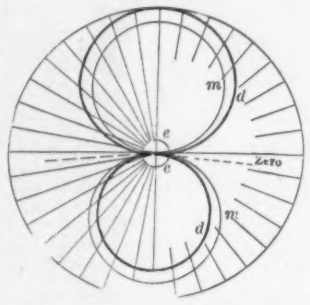


FIG. 3.—COMPOSITION DIAGRAM OBTAINED FROM FIG. 2.

that is, when it is placed with its plane radial to the transmitter. If the wire circuit has in series with it the proper capacity making the oscillation period the same as the period of the wave, greater effects will be obtained.

In Fig. 1, *A B* represents the plane of the coil when placed radial to the source. If *I* is the current when the coil is on position *A B*, then, when placed in direction *B C*, the current will be represented by $I \cos \Theta$ which is given by length *B C*, where *A C B* is a right angle. The complete polar diagram is the locus of *C* and is obviously a circle, *A C B D* having a diameter *A B* with the pole at *B*.

A similar circle $B\ C^1\ A\ D^1$ below the first one will represent the currents when the coil is in the other two right angles. In the latter case, however, all vectors for the lower circle must be called negative, because the currents are induced in the coil in the opposite direction.

If the coil in practice is straightened out into a horizontal wire and one end is grounded, it will form an oscillating circuit with the ground enclosing the horizontal magnetic forces.

In fact, it will act as a coil of one turn with a condenser in series with it.

The vertical forces, which may be called the electrical forces, will probably have an action on the wire proportional to some function of the height, and the wire will receive these from all directions equally. Their polar diagram will be a circle with its center at the pole. The forces proportional to the radius vector from *B* in Fig. 1 may be called the magnetic forces. Any aerial

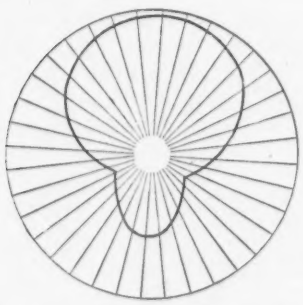


FIG. 4.—COPY OF DIAGRAM FROM MARCONI'S PAPER.

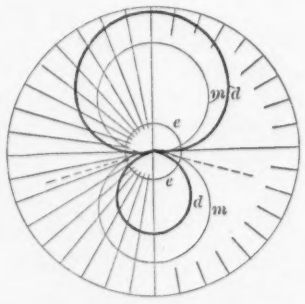


FIG. 5.—COMPOSITION DIAGRAM OBTAINED PROM FIG. 4.

partly horizontal and partly vertical will receive the sum of the two forces. Fig. 1 gives the case when no electrical forces are present.

Fig. 2 is Marconi's diagram showing the currents received in a horizontal conductor 30 meters long lying on the ground, when rotated from 0° to 360°. If it be assumed that this diagram is made up by the addition of the two sets of forces, it should be possible to find out their values. Half the difference of the radiations in the two maximum directions will give the radius of the circle representing the electrical force, and half of their sum will give the diameter of each of the circles representing the magnetic force. These two sets of circle *e e* and *m m* are shown in Fig. 3 and the composite curve (*d d*) is obtained by summing—with proper regard to phase. It is interesting to note the direction of the zero radiations in the theoretical curve and the minimum of Marconi's curve.

Fig. 4 is a curve obtained by Marconi with the same transmitting and the same receiving system, except that the receiving wire is now placed 1.5 meters above the ground. One might expect that the electrical force would now be greater, and, in fact, the analysis shown in Fig. 5 indicates a much larger value of the electrical force compared with the magnetic force. Of course, it is also possible that the latter may have at the same time decreased. It should be noted that the maximum effect is always in the direction opposite to that in which the conductor points.

Very few results of tests have as yet been published, so that definite conclusions cannot be drawn, but if the arguments outlined above are correct the increase of the ratio of height to horizontal length, so as to increase more and more the electrical compared with the magnetic forces, can be indicated by the simple summation of two polar diagrams. With the value of electrical force equal to the maximum magnetic force, the heart-shaped diagram of Fig. 6 (curve A) will be produced—indicating that in this case there will be no reception in the direction in which the free horizontal end points.

As the electrical force increases still more, the curves will gradually approach a circle in shape. Curve B of Fig. 6 shows the case where the electrical force is equal to twice the maximum magnetic force. The diagrams in Marconi's paper indi-

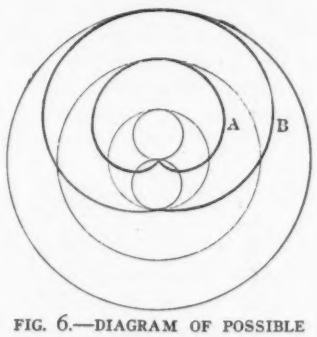
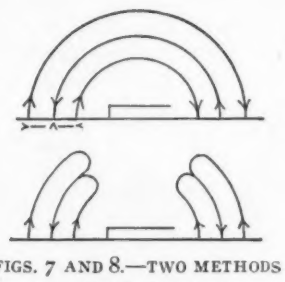


FIG. 6.—DIAGRAM OF POSSIBLE CASES OF RADIATION.



FIGS. 7 AND 8.—TWO METHODS OF RADIATING WAVES.

cate that very similar effects are produced by the transmitter, showing again a combination of two forces.

Fig. 7 indicates how the wave is probably thrown off due to the magnetic induction of the horizontal wire on the earth by an action similar to that of an auto transformer, and Fig. 8 shows the wave sent off due to the ordinary effect like that in a vertical wire. These two effects added together give polar diagrams similar to those shown for the receiver.

If a T-shaped aerial can be considered as two inverted L-shaped aerials then on the polar diagram the magnetic forces will annul and the radiation will be given by a circle having its center at the pole. A horizontal wire with no ground connection and the exciter or receiver placed at its center would probably give the nearest approach to the simple polar diagram of Fig. 1, with minimum signals at right angles to the direction of maximum radiation.

In considering the radiation by these two methods combined, it must be noted that the law of decrease of signals may not be the same for each, and that at different distances from a transmitter different diagrams may be produced.

After the above was written the writer was referred to Prof. Larmor's remarks in the discussion on Mr. Marconi's paper at the Royal Society in England. Prof. Larmor pointed out that the bent antenna employed by Mr. Marconi is equivalent in effect at distant points to the combination of a magnetic doublet or bi-pole magnetic oscillator of the kind investigated, in advance of Hertz's discovery of electric radiation, by Prof. G. F. Fitzgerald, and a straight Hertzian doublet or bi-pole electric oscillator. It is obvious that if a straight electric oscillator is placed in contiguity to one side of a closed rectangular circuit or magnetic oscillator, the currents being of the same value and directed in an opposite sense in the open and adjacent side of the closed circuit, the resultant electromagnetic effect must be that of a doubly bent oscillator of the type considered in the text.

The Alternating-Current D'Arsonval Galvanometer.

BY W. S. FRANKLIN AND L. A. FREUDENBERGER.

WHEN the bobbin of a D'Arsonval galvanometer, supplied with alternating current, is suspended in an alternating magnetic field of the same frequency, a unidirectional torque acts on the suspended system. For the most effective torque action the alternating field must be nearly in time phase with the alternating current in the suspended coil. The instrument is then similar in principle to the alternating-current shunt motor.

The field magnets of an instrument constructed by the writers consisted of iron stampings assembled in "C" shape. The bobbin was suspended in the opening of the "C." The section of the iron was 2½ in. by ⅝ in., the width of air-gap 1 in. Two coils, each consisting of about 700 turns of No. 20 B. & S. cotton-covered wire were placed as close as possible to the air-gap, and connected in series. The magnetizing current was obtained from 110-volt, 133-cycle mains; it was led through these coils, then through a variable inductance, a two-microfarad condenser and a lamp bank (all connected in series). The iron core of the variable inductance was pulled out until the lamps were at their greatest brilliancy, under which condition the current was practically in time phase with the line electromotive force. With a current of 1.5 amp., the field intensity (effective) in the air-gap was about 1,000 lines per sq. cm.

At this density the iron in the field magnets produced a loud "humming" sound (frequency of mains) and made the suspended coil vibrate so much that the spot on the scale was indistinct and blurred. The iron stampings should have been riveted together more firmly, which probably would have helped in reducing the vibrations. To eliminate this effect the coil was suspended inside of a long glass tube and the tube completely filled with gasoline. In order to be able to view the mirror, an opening was blown in the tube, the surface ground plane, and a piece of plate glass used to cover the opening. The plate glass was tied on securely and the joint made tight by a washer cut out of thin sheet rubber. The reflection of the scale was then distinctly visible in the telescope. Placing the suspension inside a glass tube also served the purpose of thoroughly insulating the coil from the field circuit—as the e.m.f. across the condenser in the field circuit amounted to about 500 volts.

The bobbin of the galvanometer was connected, through an adjustable inductance and a one-microfarad condenser, to a reversing switch (all connected in series). A resistance was also connected across this end of the reversing switch (in shunt). The other end of the reversing switch then became the terminals of the galvanometer, into which was led the current to be measured, which was obtained from the same circuit as the field current.

With capacity predominating in the circuit from the reversing switch to the galvanometer bobbin, the torque which acts places the plane of the bobbin at right angles to the plane of the field. With inductance predominating, the torque places the plane of the bobbin parallel to the plane of the field (working position). The value of the resistance across the reversing switch regulates the value of the torque, which places the bobbin in its equilibrium position. This resistance is made as high as possible to obtain high sensibility, so that only a very weak torque acts to keep the suspended system in its equilibrium position. The greatest value of this resistance that could be used was 1,000 ohms. The bobbin, which was wound with No. 40 B. & S. gauge, single silk-covered wire, had a resistance of 200 ohms. The sensibility obtained was 1.0×10^{-7} amp. per millimeter with the scale at one meter's distance; period, 1.0 second.

The same bobbin was taken out and suspended between the poles of a permanent magnet and its sensibility tested with direct current (ordinary D'Arsonval galvanometer). Its sensibility was found to be 3.0×10^{-8} amp. per millimeter per meter; period, 4.8 seconds.

The cast-iron pole pieces of the permanent magnet had a section about four times as great as the section of the hard steel magnets. Assuming the magnets saturated at 8,000 lines per sq. cm., the density in the air-gap was 2,000, against a density of 1,000 for the alternating-current arrangement. The lengths and thicknesses of the upper suspensions were the same in both cases. The lower suspension of the direct-current arrangement consisted of the usual phosphor-bronze spiral spring. The lower suspension for the alternating-current instrument consisted of a long phosphor-bronze wire (1.5 mils in diameter and 8 in. long), carrying a heavy pointed copper wire dipping in mercury contained in the bottom of the glass tube. Connection was made to the mercury by a platinum wire sealed through the glass.

From the above results it appears that for equal strengths of fields the alternating-current instrument is, in general, almost as sensitive as the direct-current arrangement. In designing an alternating-current instrument, the main difficulty consists in obtaining a sufficiently high strength of field without making the condenser in the field circuit unduly large.

How Much Money Should a Central Station Expend for Advertising Purposes?

Among the queries answered in the "Question Box" presented at the Atlantic City Convention of the National Electric Light Association are a number relating to expenditures of central stations for advertising purposes. The queries and answers on this subject are reprinted below:

How much is an electric light company justified in spending for the securing of new business per dollar of revenue thus secured?

About two per cent of gross revenue. This depends on the longevity of the business secured. Assuming a five-year average, it may be conservative to spend in the commercial department, to secure new business, one-fifth of the net revenue realized from the business the commercial department obtains. This would make the expense of the commercial department equal to all the net revenue from the first year's net receipts from the business it obtained, the remaining four years' net receipts being actually realized as net. This commercial department expense is entirely apart from investment and equipment charges and expenses and costs necessary to render service. A company might be justified in spending 50 per cent of the gross revenue at certain times under certain conditions. One per cent under other conditions might be more than enough. To spend 50 per cent of the gross for one month would stagger most central station men. Howbeit, there are cases where such a move would come under the head of sound business. The possible business must govern the outlay. If there are 500 or 5,000 non-consumers and each non-consumer could be made to spend $20 a year with the company, spend $5.00, $10, even the entire $20, if conditions are such that you are sure to hold the business for the second month or the entire year. The proportionate amount will vary according to the territory and local conditions. An average expenditure of 10 per cent of the annual return from the new business secured is reasonable. Much new business can be secured at less expense, but each additional block of new business will involve a proportionately higher cost. The wide-awake company will go after all possible business of a reasonably permanent character. Where necessary a company could probably afford to pay as high as 50 per cent of the annual returns for business that is expensive to secure, but this would be an extreme figure.

What percentage of gross receipts is it advisable to appropriate for total advertising, including bulletin and publicity expenses and regular advertisements?

There are no two cases alike. Some department stores set aside two per cent of their gross for advertising; this is a fair average—some more, some less, however.

Give the percentage of the total amount appropriated to be devoted to each of the different ways of securing new business.

Sixty per cent on personal solicitation is about the right average. Forty per cent spent on the proper kind of advertising will assist the soliciting force. The two must work together—one

without the other will not show as good results as if combined, and a campaign of co-operation is laid out. A mail advertisement should be followed by soliciting; so should newspaper copy be followed by a personal visit. Hit the iron while it is hot; keep the iron hot and keep hitting.

Assuming an annual advertising appropriation of from $5,000 up, is it better for a public service corporation to lay out its own advertising campaign in its own office in view of local conditions, or is it better to place the matter in the hands of some advertising concern of recognized ability?

There should be no reason why your advertising manager, if he has taken a good course in the profession, should not be fully as competent to plan a good campaign, if not more so, particularly so in view of his thorough knowledge of local feeling—a qualification seldom possessed by experts or concerns far removed from the city involved. It is advisable to employ an outside advertising concern having experience in the electric field unless the appropriation is large enough to support a competent advertising man with necessary assistants; $5,000 per annum would just about pay the salary of a fair man and the incidental running expenses of his department. The employment of an advertising expert or advertising concern of recognized ability is advisable, provided they be employed primarily in a consulting or advisory capacity. The policy of putting the execution of an advertising campaign into their hands is open to question. If an advertising man had $5,000 to spend for a motor it would certainly pay him to give a portion of the money for the advice of an expert electrical man. So it is with the central station man. He may know how to write bright things—may have good ideas for copy—but the advertising expert knows more from experience. The central station man has common sense—let him use that. There is good advice—bad advice. Certain things appear bright and clever to him; they may be costly brightness. No advertising expert can give the same advice to every central station man. He must submit a list of questions; he must understand local conditions before he can carry on the proper work. If the public service corporation can secure the exclusive services of an advertising man of equipment, experience and ability by hiring such a man, organizing its own advertising department and conducting its own advertisng campaign out of its own office, the corporation is, in my judgment, far more likely to achieve profitable and satisfactory results. Such an organization is certain to be more in touch with the business, to grow closer to it, in comprehension and expression, than an essentially foreign agency, the primary allegiance of which is due not to the public service corporation, but to the outside advertising concern. The situation is no different from what it would be if it affected the highest executive offices of the corporation. To conduct the general management or the operating superintendency of the company we should not consider for a moment the proposition of hiring an outside agency (however expert) whose energies and responsibilities were scattered over a number of enterprises. No, we must have our general manager and our chiefs of operating, contract and meter departments always on the spot, where they grow to be part of the life of the corporation, familiar with its past history and its present needs, aware of its possibilities and limitations, prepared for special situations or emergencies as they may arise, impregnated with the local atmosphere and with the enthusiasm and loyalty of the service. The advertising department of a highly organized and well-regulated public service corporation should be one of the most important factors in its business existence, for the function of such a department should be not only to sell electricity, not only to inform and educate the public and to popularize the service by demonstrating its superiority and familiarizing people with its various uses, but it should also have largely in charge, through its newspaper connections, the public opinion relations of the corporation to its constituency; that subtle, close and delicately poised relationship, the immense significance of which is but now beginning to be fully realized. In other words, the advertising manager should be not only a star salesman, but, in co-operation with the executive officials, he must be the custodian of the company's reputation and of that very real asset, the public good will. This function, in the nature of things, no outsider can adequately administer. It requires a man of discretion, understanding and conservative imagination, with mind and purpose singly devoted to the service of the company. The central station that can afford an A-1 advertising man has no business with syndicate services and advertising agencies.

What percentage of gross receipts should be used for advertising in a city of 10,000 or 12,000 inhabitants?

This depends entirely on how the field has been previously worked. If the business has not been developed, spend as much as you can stand. Every new customer increases the earning value of your property by $100. Two per cent should bring splendid results. Two per cent of gross receipts, or charge part of superintendent's time to advertising. The percentage of gross receipts that should be expended on advertising varies largely. Where a solicitor or solicitors are employed, more money can be afforded for advertising than if the solicitors were not employed, for money spent in advertising will be invested to much better advantage if the resultant inquiries are followed up by solicitors. I firmly believe in advertising, from my boot soles up, but I don't have any false views on it. Advertising, considered purely alone—even the very best kind of advertising—direct mail solicitation—will not pay a heavy return on an investment unless it is used directly in connection with and followed up by personal solicitation. So, in this answer, I assume that the question of the percentage of expenditure of the gross receipts on advertising means when advertising is properly done in connection with solicitation, so as to get the highest efficiency in resultant new business. The largest volume of returns through advertising secures business that would not otherwise be obtained immediately, and in many cases business that would not come "naturally"—that is, without the exertion of advertising solicitation—until after several years, the net income, meantime, obtained through advertising would in most instances pay for the advertising many times over. Thus, if a customer for a sign is secured through direct mail solicitation and the annual revenue is $60, then, if we assume that the customer would have come on "naturally" at the end of five years, the central station has secured a gross income of $300, and in the meantime the net profit would have paid many times over the cost of the advertising plus the cost of solicitation. The expenditure of money for an advertising appropriation where the company is prepared to back up the advertising by solicitation, and carefully and conscientiously take care of the customers secured—promptly and efficiently—should be based, not on a percentage of the gross receipts, but contrariwise, should be every cent that the central station can get to put into this vehicle for expanding its business. Advertising secures new customers. New customers should be considered as an investment and should be paid for and charged to investment account just as surely as though the company had purchased the customers from another company. So far as getting the customer is concerned, where is the difference between buying them from another company or going to the expense of purchasing them through advertising? In either case the customers have to be paid for, and it seems wrong to charge them in one instance to expense account, and in the other instance charge them to the investment account. Surely, if an electric light company is willing to pay from $50 to $150 each for new customers, even from a competing local company, then it ought to be willing to pay anywhere from $2.00 to $10 each for the same class of customers through advertising in a little town. Just as surely as they would charge the purchase price to the investment account in the first instance, they ought to charge the smaller amount to the investment account in the latter instance. I believe this statement to be a logical one from a conservative viewpoint, and I believe that, while it is not now generally done, it will be done within a few years, just as is done in other businesses which have advertised for a good many years, where the advertising is done for the purpose of securing customers, which, in a majority of the cases, remain as constant customers year after year. This latter point should be held strongly in mind as differentiating central station advertising from a class of advertising where the resultant business is only a desultory sale, in which instance there is not a constant income from the customer, but the profit is all made on one sale. Let the reader think this over and, before con-

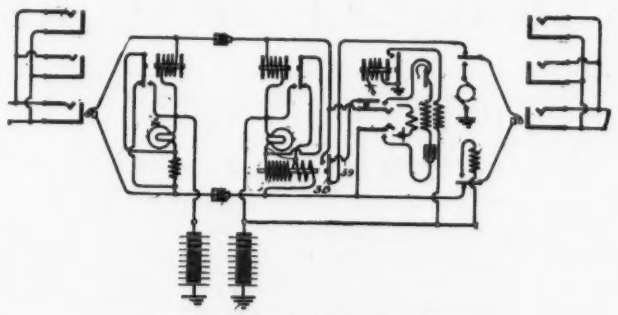
demning the stand, find any flaw in the argument. It is true that when customers are purchased from another company the apparatus and copper for serving the customers are also purchased. Even then, deducting the cost of the material necessary to serve the customers, it will be found that the price paid for each customer is largely in excess of what it would cost to procure that customer through advertising. Consequently, the inference seems a plain one that new business obtained through advertising should not be handicapped by charging the cost of obtaining it to expense account when the expense of obtaining a similar customer would be charged to the investment account of the customer were purchased from another company. Smaller cities of from 10,000 to 12,000 inhabitants can get a more profitable return on money expended on advertising than is the case in the larger cities, because the customer in the smaller towns can have more effect produced on his mind by a small expenditure of money than his busier brother in the large city. It is true that in the smaller town the new money is not always forthcoming to purchase the new customer, either by advertising or outright purchase from another company, and in that event as large a percentage as possible of the gross receipts should be expended on the procurement of new business. No two cases are the same, and no fixed percentage of gross receipts can be set down as a rule to be followed in individual cases where local receipts and conditions may vary widely. There is no manufacturing business in the world in which the percentage of fixed charges and general expenses so rapidly decreases as in the production of electricity. Consequently, every effort should be bent and every cent possible should be expended toward increasing the number of profitable customers.

New Telephone Patents.

SWITCHBOARD CIRCUIT SYSTEMS.

Practically all common battery, two-wire switchboard systems have required three or more relays in each cord circuit for full supervision. These relays have been of two classes—the one to control the general current supply performing the function of the third wire of the cords of three-wire systems, the other performing the usual supervisory functions.

Mr. W. W. Dean has obtained a patent for a circuit in which the control relay is done away with, as shown in the accompanying



DEAN SWITCHBOARD CIRCUITS.

illustration, where it will be seen that the supervisory relay has both front and back contacts, which are so disposed in the circuit as to shunt out the supervisory lamp in its actuated position, at the same time removing a shunt from a resistance so that the net resistance of the circuits will not be affected. There seems to be no reason why such an arrangement should not be most satisfactory. Mr. Dean's patent is assigned to the Kellogg Switchboard & Supply Company.

J. L. McQuarrie has patented a special station signal system for party lines. Where for any reason it is necessary to make special charges against any line, there arises a question of the veracity of the user in giving his station. To overcome this Mr. McQuarrie has devised a special audible signal for each station, which the operator can sound. The signal is located on the subscriber's premises and is only cut into circuit when the receiver is off the hook. Thus, the operator obtains at will first-hand information of whom to charge from the sound of the signal. This patent has been assigned to the Western Electric Company.

The Sterling Electric Company, of Lafayette, Ind., has been assigned the patent for a lamp signal magneto system recently granted to S. B. Fowler. This system depends upon the substitution of a locking relay for the usual drop. The relay has two windings, one of which under action of the magneto currents from the stations causes the relay armature to come up. In this position it closes the circuit of a lamp signal which is in series with a second winding of the relay. The relay thus becomes locked up, the lamp glowing continuously. Upon the response of the operator by inserting her plug, the jack contacts open to cut the relay from the line, and incidentally to break the locking circuit and open the lamp circuit.

A trunk circuit system for two-wire working has been patented by H. G. Webster. This is merely an adaptation of the usual order wire trunk system with its ringing, disconnect and guard signals. The means of operation are, of course, adapted to the switchboard with which it is to be used. The Stromberg-Carlson Company has obtained this patent.

AUTOMATIC PLUG SOCKET SWITCH.

In connection with his semi-automatic system, Mr. E. A. Faller has found it necessary to use an automatic plug socket switch, and in connection with O. A. Danielson, of New York City, has patented such a switch. The lever of this switch serves as a plug seat for the plugs in the keyboard, and it controls the switch member through a trigger. When a plug is in its seat the switch lever is withdrawn; but as the plug rises and its weight is lifted from the end of the lever, the lever rising operates the switch member through the trigger. As the connection progresses an electromagnet associated with the trigger becomes energized and trips the switch block so that it may return to the normal position until after the plug has again been restored to its seat upon the switch lever. As the lever returns to the depressed position the trigger becomes reset.

DUPLEX SYSTEM.

A modified duplex system has been patented by W. Ohnesorge, of Germany, which provides means for the simultaneous operation of exchange and extension stations on independent conversations, the transmitters of all stations receiving current from the exchange battery over the exchange line. The result is accomplished along the usual lines for duplex systems, the two sides of the exchange line serving in parallel as battery feeders for the transmitters of the extension lines. The extension line current returns to the exchange battery through the ground. The system depends entirely upon the balance of retardation coils, the neutral points of which are connected together.

DISTRIBUTING FRAME.

Approved practice for a number of years has combined arrester and main distributing frames in one piece of apparatus, the arrester terminal parts serving as the distributing terminals on one side of the frame. As more and more cable has been introduced in the wire plant, however, the condition began to arise of lines completely in cable from the exchange to the subscriber's premises. Such lines require little protection. Again, best practice has distributed the various protection factors according to the character of the line, some entirely removing central office protection on wires entering underground. Therefore, with a mixed system it will often be found that much of the protection apparatus in an office is replaced by dummies which merely completed the circuits. To facilitate the ready conversion of parts of a frame for arresters or not, F. J. Dommerque has designed a frame complete in itself, but with an auxiliary frame of terminal bars mounted just in front of one side. The terminal bars may at will be either arrester bars or lug terminal bars, and may be changed without disturbing the frame proper. The Kellogg Company has been assigned the patent for the frame.

AUTOMATIC SYSTEMS.

The progress of the automatic idea is indicated by the continual appearance of patents for small accessories and improvements. In this line is an indicating device for the sender patented by F. A. Lundquist, of Chicago. This comprises a register, the various digits appearing in proper sequence in a window in the

sender, as these digits are sent in. Thus the user has a record before him of just what number he has sent in, in each place, and just how far he has gone. The window clears at the completion of the call.

Another improvement by the same inventor divides the sending movement between two indicating parts. The usual finger dial is stationary and the number is set by an arm, in conjunction with which is a pointer. When the pointer indicates the desired digit, the arm is released. This act permits its return to the home position during which it leaves the pointer behind locked in position. As soon as the arm reaches home it itself becomes locked and the pointer unlocked. The arm remains locked till the pointer reaches home. Such a two-part arrangement effectually bars tampering with the selector to make false operation of the apparatus, as the returning pointer sends the current impulses.

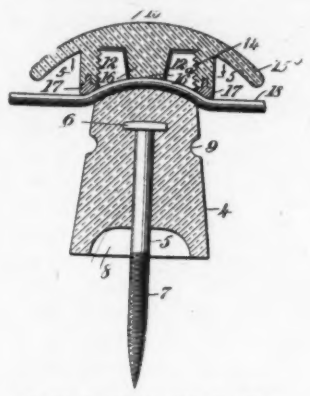
A new automatic apparatus has been patented by A. A. Monson, of Grey Eagle, Minn. This system is adapted to a small group of lines, and has as features a lockout device by the use of which but one call may be handled at a time. This insures privacy at the expense, of course, of service. This lock-out feature is, however, optional, being controlled by a switch. Another feature is a motor which upon the breaking of the circuits upon completion of a conversation clears out by restoring all parts to normal.

Letter to the Editors.

High-Tension Insulators.

To the Editors of Electrical World:

Sirs:—In your issue of August 11, 1906, an article entitled "Semenza High-Tension Insulator" interested me because the experiments which it describes seem to have demonstrated in a practical way that the application of a protecting hood or shield to insulators, especially high-tension insulators, gives very favorable results. In this connection I beg to call your attention to letters patent issued to me February 21, 1905 (No. 783,229) on an application filed March 19, 1903, which established my invention of this method. The invention, moreover, was completed by me a considerable time previous to the filing date. To quote from the specifications of the patent and referring to the accompanying reproduction from the patent cited: "My invention relates more particularly to an improved insulator for carrying wires for electric light, power and telegraph service, and in all other relations where wires are required to be insulated from their supports. * * * In Fig. 4 the cap, 15*a*, is provided integrally with an umbrella-shaped shield or web, 15*b*. The purpose of this shield is to ward off rain, sleet, etc., from the annular member, 17, and from the wire, 18, at the points where it is engaged, thereby to prevent leakage due to moisture. * * * I do not limit myself to any particular shape for the



HIGH-TENSION INSULATOR.

slot, 10, or the enlargement, 13. Neither do I limit myself to the exact construction of any of the other several parts shown."

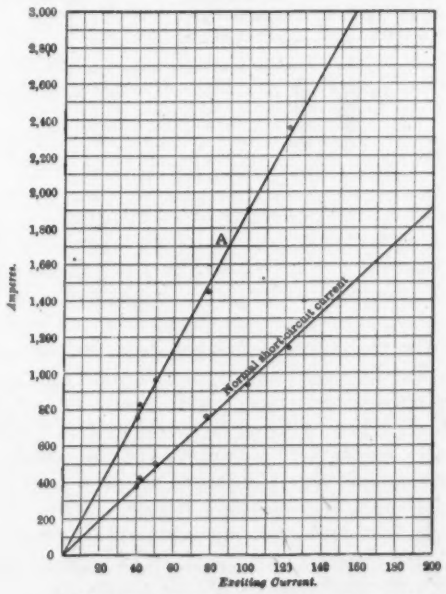
It may also interest you to know that I have recently designed insulators for 80,000 volts and 100,000 volts commercial service, and I know of no particular reason that would deter me from designing insulators for 150,000 volts commercial service, and I am prepared to design and manufacture high-potential insulators with hoods having a diameter of 36 in. or more, with a guarantee to keep them in good working condition. As a matter of fact, I believe that by my inventions the Niagara power companies may supply electric power to consumers in New York City.

Brooklyn, N. Y. Louis Steinberger.

Digest of Current Electrical Literature.

Dynamos, Motors and Transformers.

Short-Circuiting of Alternators.—Punga.—An investigation of the factors which effect the difference between a gradual short-circuit and a sudden short-circuit. The main result of his analysis is that "after a sudden short-circuit, the field current increases within a quarter of a period to a maximum value. The number of lines that would be linked with the field circuit if the generator were very gradually short-circuited with the preceding maximum value as excitation, would be just as large as with normal excitation before the short-circuit." The effects of a sudden short-circuit are an increase of the excitation current, a considerable momentary overload of the exciter, a considerable increase of the armature current over the normal short-circuit current, a considerable force on the spool heads, due to the very high armature current. The load of the generator is represented by the I^2R losses in the armature circuit. If the armature contains a comparatively large ohmic resistance, or if the short-circuit occurs at a distance from the generator, thus inserting an external resistance into the armature circuit, the armature current may still become considerably higher than the normal short-circuit current, and the I^2R losses may represent a dangerous overload on the generator. The author has studied, together with Hobart, these phenomena on a 5,000-kw, three-phase generator. Fig. 1 gives experimental results on the normal short-circuit current and the sudden short-circuit current for various field currents. In this case a hot-wire instrument was placed in the armature circuit, and the values in curve A are only the maximum deflection of this instrument. As a hot-wire instrument requires a longer time to follow a sudden variation



MAXIMUM INDICATION OF AMMETER.

of the current, it may be concluded that the maximum value of the armature current was considerably higher than that given

in curve A. It seems, therefore, advisable to protect the generator against the effects of a sudden short-circuit. Hobart has proposed to put a quick-acting maximum cut-out into the field circuit. This cut-out could be conveniently arranged so that a resistance is inserted into the field circuit as soon as the field current increases by more than 30 to 50 per cent. It is also advisable to clamp the spool head firmly together in order to prevent a displacement. If micanite ducts are used, great care should be devoted to the place where the ducts leave the iron, since it is here that the greatest danger is experienced with the insulation.—Lond. *Elec.*, August 31.

Lamps and Lighting.

Long-Flame Arc Lamps.—LEONARD ANDREWS.—A paper presented before the British Institution of Electrical Engineers, in which much information is given concerning the "Carbone" long-flame arc lamp. The essential difference between this type of lamp and other forms of flaming arc lamps lies in the magnetic control of the arc, the shape of the flame being such as to prevent flickering and to reduce to a minimum the absorption of the light from the crater by the arc mist. The magnetic controlling device consists of a closed magnetic circuit, the only field affecting the arc being that due to magnetic leakage from this closed circuit. The mechanical arrangement of the leakage path is such as to produce a weak hemispherically-shaped leakage field of just sufficient strength to maintain the craters at the tips of the carbons. The author assumes that the candle-power emitted by the positive crater is proportional directly to the area of such crater and that the increase in effective illumination of the inclined carbon arc lamps is partly due to the fact that no appreciable portion of the light emitted is intercepted by the negative carbon or the arc mist. In a chemical carbon arc the bulk of light emanates from the flame and is apparently due to minute burning particles in the flame which are raised to a very high state of incandescence. The author stated that inclined carbon arc lamps operate with fair satisfaction with 25-cycle current. The flickering is very much less noticeable than with lamps having coaxially arranged carbons, due to the fact that in a flame arc the craters are alternately at a maximum and simultaneously visible.—*Jour. Ins. Elec. Eng.*, August, 1906.

Waste in Electric Lighting.—GEO. WILKINSON.—A paper presented before the Leeds local section of the British Institution of Electrical Engineers. Every enterprising station engineer diligently seeks to reduce the cost of production. Labor-saving appliances have done much towards reducing the production costs. Electrical engineers have too long considered themselves simply producers and purveyors of electrical energy and have not concerned themselves with the problem of turning a minimum amount of electricity into a maximum of illumination, the consequence being that many a user in paying for double the amount of electrical energy for lighting he ought to pay, and not a few electric light consumers have gone back to the use of gas. The author sets forth a few cases of unnecessary waste which have come under his personal notice; in some cases the consumption varied from 6 to 12 watts per candle. The cost of electric lighting is greatly increased in many towns due solely to errors in the grading and marking of lamps. He suggests that each lighting company should systematically test all lamps used on its circuits, and should insist on the use of lamps of satisfactory efficiency.—*Jour. Ins. Elec. Eng.*, August, 1906.

Power.

Electric Pumps.—PHILLIPPI.—The efficiency of centrifugal pumps is the higher, the greater the speed. They are, therefore, especially adapted to be driven by three-phase motors. A considerable advantage lies in the fact that the centrifugal pumps need only a small starting torque so that slip-rings are not required for the motors, but short-circuited armatures may be used in connection with starting transformers, so that the motors may be of a very simple and strong construction. A great advantage of electric pumps over steam pumps is that there is no steam in the pit, and that the temperature at the bottom is not increased. The author describes in detail three-phase motor-driven centrifugal pumps of the Wilhelmina Grube near Heerlen in Holland. The power plant contains two three-phase dynamos, each of 235 kilovolt-amp. with a maximum tension of 2,200 volts running at 125 r.p.m. The voltage is reduced to 500 for driving the pumps. There are three pumps, two for raising 1 cubic meter of water per minute to a height of 225 meters, the third for raising 2 cubic meters per minute the same height. The installation is described in detail with many illustrations.—*Elek. Zeit.*, August 30.

Traction.

Paris Street Railways.—An abstract of the annual report of the Paris electric street railways. The power station in Bercy contains eight three-phase dynamos of an aggregate capacity of 14,400 kw. There are nine sub-stations. The increase in traffic has caused the company to buy electricity from one of the Paris central stations. There are now 305 motor cars and 370 trailers, while 56 more motor cars and 93 more trailers will soon be installed. The condition of the air in the subway is very bad. The employes suffer from dust, which contains a high percentage of iron particles, due to wear and tear of wheels and rails. Air shafts will now be provided and one of them will be equipped with a large ventilator. The financial condition of the company is very good, although it is operating under rather stringent conditions, it having paid a dividend of 3 per cent in 1900, 6.2 per cent in the next three years and 8.2 per cent in the last two year.—*Elek. Zeit.*, August 30.

Stopping Cars on Grades.—An account of experiments carried out by the New Jersey & Hudson Railway and Ferry Company in order to determine the retarding effect of a sanded track under different conditions of speed and depth of sand. In order to avoid accidents on the line on the Palisades it has installed a switch or siding track, the rails of which are always covered with a layer of sand. The switch point at the entrance to this sanded track is always open to the main line, so that should a car get beyond the control of the motorman, it would necessarily take the switch and run into the sanded track, thereby coming to a stop automatically. The tests were conducted to obtain the proper dimensions of the trough filled with sand, which surrounds the rails of the safety siding. The Palisades road has a grade of 7 per cent.—*St. R'y Jour.*, September 8.

Installations, Systems and Appliances.

British Central Station.—An abstract of the annual report of the municipal central station of Glasgow. There were sold during the last year 21,536,425 kw-hours as compared with 18,248,468 kw-hours in the preceding year. The total cost per kw-hour, including capital charges, was 4.282 cents, against 4.472 cents for the year before.—Lond. *Elec.*, August 24.

Remote Control.—Some notes on electric resistance of remote controllers for the turrets, rudder, etc., used in the Italian navy.—Lond. *Elec.*, August 24.

Wires, Wiring and Conduits.

Temperature Raise of Three-Phase Cables.—An account of tests made by a German company on the heating of cables buried in earth ½ a meter below the ground. Five different cables were tested. The results of one of them is shown in Fig. 2,

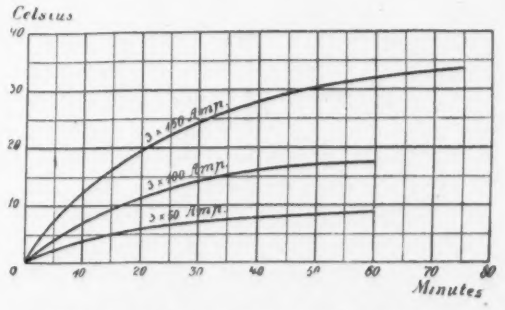


FIG. 2.—TEMPERATURE RISE OF CABLES.

which refers to a 10,000-volt cable with 3 × 25 sq. mm. per section.—*Elek. Zeit.*

Underground Armored Cables.—MARCHENA.—A paper read before the International Society of Electricians of Paris, on admissible pressures for use of underground armored cables. He

gives some details of three cables for 28,000 volts, which were tested near Toulon. Cables of that kind can be used with the utmost confidence for service of from 20,000 to 22,000 volts.—Lond. *Elec.*, August 24.

Electrophysics and Magnetism.

Thermo-Electricity.—Henderson.—The author calls a "thermo-element of the first class" a cell in which the two electrodes are of the same metal and are immersed in a solution of a salt of this metal. In such a thermo-element, in the case of zinc, copper, cadmium and mercury, the warm electrode is the cathode. In the case of silver, on the other hand, the cold electrode is the cathode. The tests to which silver was subjected indicate that this phenomenon is not due to some peculiar property of a special electrode, since many different forms and conditions of the metal were used, and always with the same result. In the case of silver, the resultant electromotive force, due to a given difference of absolute temperature, is more than five times as great as the computed osmotic pressure changes would require. Finally silver shows an anomalous change of thermo-electromotive force with change of concentration. An increase of concentration in the case of zinc, copper and cadmium gives an increase of electromotive force. In the case of silver, the reverse is true.—*Phys. Rev.*, August.

Rays of Radium.—Allen.—A long account of an experimental investigation of the velocity and ratio of electric charge to mass of the electron for the primary and secondary rays of radium. The values of this ratio for both the primary and secondary beta rays show that the apparent mass of the particles increased as the speed approaches the velocity of light. His results, together with those of Kaufmann, furnish evidence in favor of the view that the mass of an electron is entirely electrical in nature.—*Phys. Rev.*, August.

Electrochemistry and Batteries.

Discharges Through Air.—Cramp and Leethan.—A long illustrated paper read before the British Asso. for the Adv. of Science on electric discharges through air and the commercial production of ozone and nitrogen oxides, and the use of a mixture of both gases for bleaching.—Lond. *Elec.*, August 31.

Units, Measurements and Instruments.

Measuring the Voltage at the End of a Line.—Rasch.—In alternating-current lines it is possible to measure in the station the voltage at the end of the line without using any auxiliary wires. For this purpose two measuring transformers are used, the secondary windings of which are in series with a voltmeter. The primary winding of one transformer is acted upon by the bus-bar voltage, and that of the other by a quantity which is proportional to the current and the impedance of the line and in phase with the current. The readings of the voltmeter, which is in the low-tension circuit of the transformers, are proportional

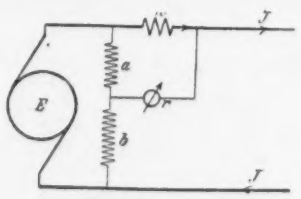


FIG. 3.—CIRCUITS WITH ONE DYNAMO.

to the voltage at the end of the line. On account of the transformers this method cannot be applied on direct-current circuits. The author describes several methods for direct current: First, in a two-wire system, let $2W$ be the total resistance of the line from the station to the end and the return circuit, J the current, V the voltage at the end of the line. In the station a resistance, w, is inserted in one of the circuits, while $a\,b$ are two high resistances and are connected as shown in Fig. 3, which also shows a voltmeter with the resistance, r. The voltage, v, read at the voltmeter is at any moment proportional to the voltage, V, at the end of the line if $(a + b)\ w = 2\,a\,W$. In this case the relation between v and V is given by the equation:

$$V = v\left(\frac{b}{r} + \frac{2W}{w}\right)$$

If, for instance, w equals $0.08\,W$, then b equals $24\,a$ and

$$V = v\left(\frac{24a}{r} + 25\right)$$

If a is chosen about as large as the resistance r of the voltmeter, the readings of the latter are about the 50th part of the voltage at the end of the line. If in a three-wire system the voltage between the two outers is to be measured at the end of the line, the arrangement shown in Fig. 4 is to be used. In this

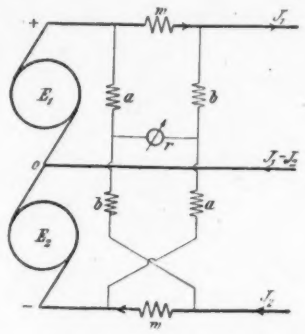


FIG. 4.—CIRCUITS WITH TWO DYNAMOS.

case the reading v of the voltmeter is proportional to the voltage V at the end of the line, if $w\,a = W\ (a - b)$; under this condition

$$V = v\left(\frac{2\,a\,b}{r\,(a - b)} + \frac{a + b}{a - b}\right)$$

If w equals $0.04\,W$ and a is made of about the same order of magnitude as r, the voltage read at the voltmeter is about 1/100 of the voltage at the end of the line. The author also describes a method for measuring the voltages in the two halves of the three-wire system from a distance, which method is, however, somewhat more complicated. The methods may be simplified, if, instead of ordinary voltmeters, special instruments with two windings are used. The method may also be used with sufficient exactness for determining the voltages at the feeding points of electric railways, using the rails for the return circuit.—*Elek. Zeit.*, August 30.

Synthetiser.—Milne.—A note on a new form of instrument for mechanically drawing curves which are the summation of a number of simple harmonic curves. The general principle of the instrument is the use of a long continuous wire attached at one point to a parallel motion carrying a pen bearing against a drum with a vertical axis, and passing alternately over small fixed and movable pulleys. The moving pulleys are carried eccentrically on a series of revolving wheels, each representing a constituent harmonic. Thus the resultant motion of the wire, and therefore of the pen, is a very near approximation to a summation of the various harmonic motions which are the projections of the circular motions of the moving pulleys, provided that the distance apart of the fixed and moving groups of pulleys is large compared with the amplitude of the displacement. An arrangement of coned pulleys permits of a variation of the period of a constituent harmonic by alteration of the speed ratios of the wheels. A further device is provided for varying the amplitude of a constituent harmonic.—Lond. *Elec.*, August 17; from *Proc. Royal Soc'y*, Edinburgh.

Galvanometer.—Russell.—An investigation of the dead points of a galvanometer needle for transient currents. The author emphasizes the importance of the Rayleigh correction for the galvanometer equation. It explains many of the troublesome phenomena often noticed by those engaged in practical tests. When this correction is taken into account, the usefulness of the galvanometer is considerably increased, and the ease with

which the dead points can be accurately determined enables this correcting factor to be readily found. The positions of the dead points also enable one to find the effective internal resistance of condensers. In several of the ordinary tests used in practice a knowledge of this resistance is necessary.—*Phil. Mag.*, September.

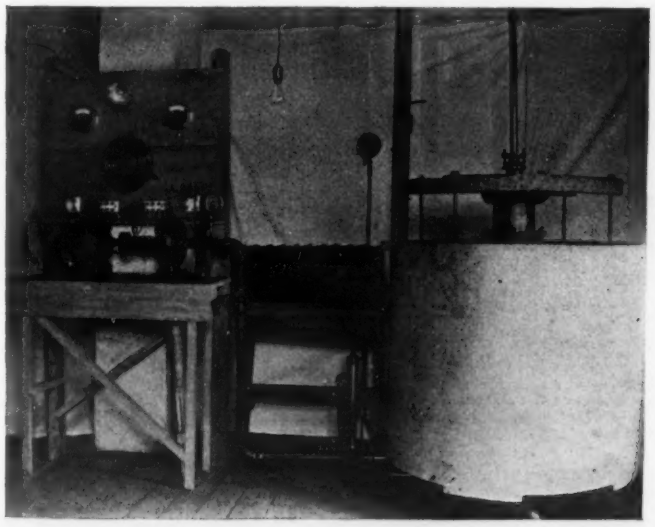
Equipment of the Cruiser "St. Louis."

The new United States cruiser *St. Louis* includes in its equipment the following apparatus built by the B. F. Sturtevant Company, of Boston, Mass.: Two 100-kw and three 50-kw generating sets with 125 volts pressure at the terminals. The engines are of the vertical cross-compound type; the 50-kw sets have cylinders 8 and 14 in. in diameter by 8 in. stroke, for the 100-kw sets they are 10 and 18 in. diameter by 10-in. stroke. The dynamos are of the direct-current, compound-wound multipolar type, and the wiring is arranged on the two-wire feed system. There are also twenty-seven electrically-driven ammunition hoists fitted to furnish ammunition to the battery. The motors are reversible and operate at about 1,000 r.p.m. Frictional slip gears are provided between the motors and the hoists to prevent damage being done in case of sudden stoppage of the hoists. Stops are fitted to prevent ammunition from falling back into the hoists. The closed fireroom system of forced draft is used and the blowers are located on the protective deck under the breeches portion of the smoke pipes, two for each fireroom. The fans are 69 in. in diameter; width of rim at periphery 25 in. The fans are driven by double upright enclosed engines; cylinders 7 in. diameter by 5-in. stroke.

The official test of the trial performance showed a consumption of 32.4 lb. of coal per square foot of grate surface under forced draft. The total horse-power required for the eight blower engines was only 122.4 hp, or about one-half of one per cent of the 26,947.4 hp, which was developed by both main engines. The temperature in the firerooms was kept down to the average of 88°.

Electric Lighting from Wind Power.

An interesting electric lighting equipment has recently been placed in satisfactory operation at Noblesville, Ind. The apparatus employed consists of a 14-ft. Star windmill on a 50-ft. tower driving a plunger pump which delivers water to a



HYDRAULIC REGULATOR AND MOTOR AND ELECTRIC GENERATOR AND STORAGE BATTERY.

cylindrical reservoir in which the hydrostatic pressure is automatically maintained at 75 lbs. per sq. in. by means of certain weights placed upon a plunger in the cylinder. When desired, the water under constant pressure is used to drive a ½-hp turbine wheel which is direct connected to a ¼-hp, 25-volt dynamo arranged to charge an 11-cell storage battery. The battery has a capacity sufficient for supplying electricity to 20 8-cp lamps for three hours or to five similar lamps for six hours, when operating alone.

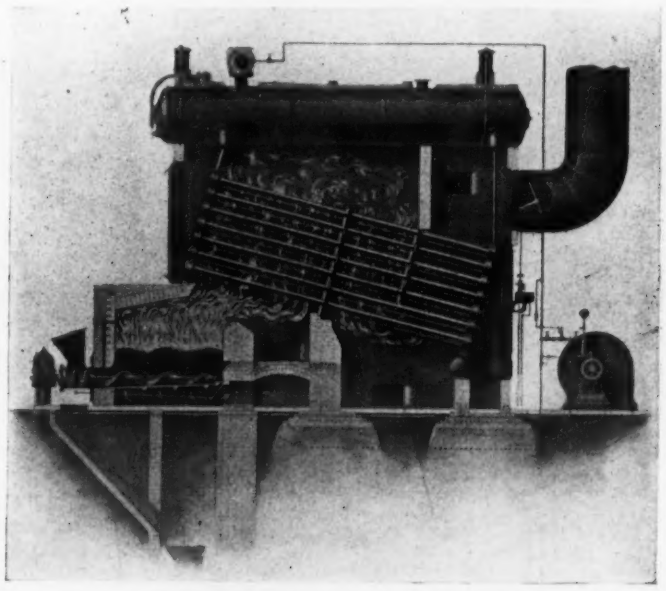
By means of automatic hydraulic devices the pump is permitted to store any energy which the windmill may produce, while automatic electric devices allow the energy to be used when needed. It is stated that with the equipment here considered, enough electricity for winter use can be obtained from five hours' operation of the windmill per day on the average, while during the summer months only two hours per day will be needed.

The equipment has been designed and installed by the Windmill Electric Company, of Noblesville, Ind. We are indebted to Mr. E. B. Cothingham, manager of the company, for the information contained in the above description.

Balance-Draft Gas-Producer Furnace.

In the "balanced draft" type of furnace there is automatically maintained at the furnace a pressure equal to the surrounding atmosphere. The balancing of the draft is obtained by throttling the suction of the chimney in exact proportion to the speed of a specially designed fan blower, which supplies air to the ashpit, the speed of the blower being governed by variations in the boiler pressure, so that a constant ratio of air to coal is maintained for all rates of combustion. Thus under all conditions of operation twelve pounds of air are allowed to combine with one pound of coal, which ratio is found to produce the maximum efficiency.

As seen from the accompanying illustration the coal feeder worm acts as a conveyor, as such term is generally understood, for about one-third of its length. The pitch of the worm of the conveyor changes, just back of the front furnace wall, from an angle in which the conveying principle predominates to an angle in which the lifting principle predominates. Neither the worm nor any part of the conveyor proper can ever be subjected to injurious heat, because combustion cannot take place in the conveyor trough, even though the supply of coal at the hopper should be interrupted or discontinued. In operation the fuel assumes an uneven surface from front to rear of the furnace and has a wave motion, each wave corresponding to a cycle of the conveyor worm. This movement has been found to be exceed-



BALANCED-DRAFT GAS PRODUCER FURNACE.

ingly advantageous, assisting in loosening up the fuel and freeing the volatile gases, thereby accentuating the producer gas furnace effect.

The patents for the method and the apparatus described above which were granted to Messrs. John MacCormack, John C. Quinn and Embury McLean are owned by The Engineer Company, 111 Broadway, New York.

Motors in an Oil-Cake Factory.

One of the most recent establishments to adopt electric drive is the Archer Daniels Linseed Company, of Minneapolis, Minn. The process of making linseed oil and cake from the raw material is very interesting, and the induction motor has been found to adapt itself perfectly to the cycle of operations. The first step in the process in which the motor has been adopted is at the storage bins. The raw material, flaxseed, is elevated by a 30-hp induction motor to the cleaning room. Here the seed is freed from dust and dirt by motor-driven fans, the refuse being sucked up and carried to the waste bins by exhaust fans driven by the same means. The flaxseed then goes to the grinding mill, the elevator and conveyors being motor driven. The grinder is operated by a 60-hp, 2,300-volt motor and the seed is reduced to meal of about the fineness of graham flour. The flour is then cooked about an hour and a half in steam-jacketed kettles and the oil is expressed by hydraulic presses, the pumps for which are driven by induction motors. From the presses the oil is pumped first to large vats, then filtered to tanks on a lower level, and again pumped to storage tanks. All these various pumps are driven by induction motors.

The switching and wiring arrangements in this establishment are very complete. All the motors of 35 hp and over are operated directly at 2,300 volts, the connections being made through three-phase, lead-covered cable in iron conduits. Each motor has a controlling panel, and these are grouped on the different floors so that all the motors in one department can be controlled from one point. The central controlling panel located in the basement receives the power from the transmission lines at 2,300 volts and distributes it through non-automatic oil switches and expulsion fuses to the various motors in the building. In an annex outside the main building a 56-kw, three-phase transformer is installed for supplying current to the 220-volt motors of small power. In this same transformer house there is also a 20-kw, single-pole transformer arranged for lighting the building. The current for the transformers is first brought to the main switchboard and then distributed to them through oil switches. From the transformers the wires run directly to the small motor and lighting panels. The complete electrical equipment of this plant was furnished by the General Electric Company.

Records of Automatic Feeder Regulator.

A description of several new types of automatic feeder regulators made by the General Electric Company appeared in the issue of August 11, which is supplemented herewith by a record of one of the types in actual service. The accompanying charts were taken simultaneously with two Thomson curve drawing voltmeters, one on either side of a type BR regulator designed to boost or lower the voltage by 10 per cent. The generator voltage (Fig. 1) was purposely varied over a wide range, so that the conditions were more severe than those usually holding in actual service.

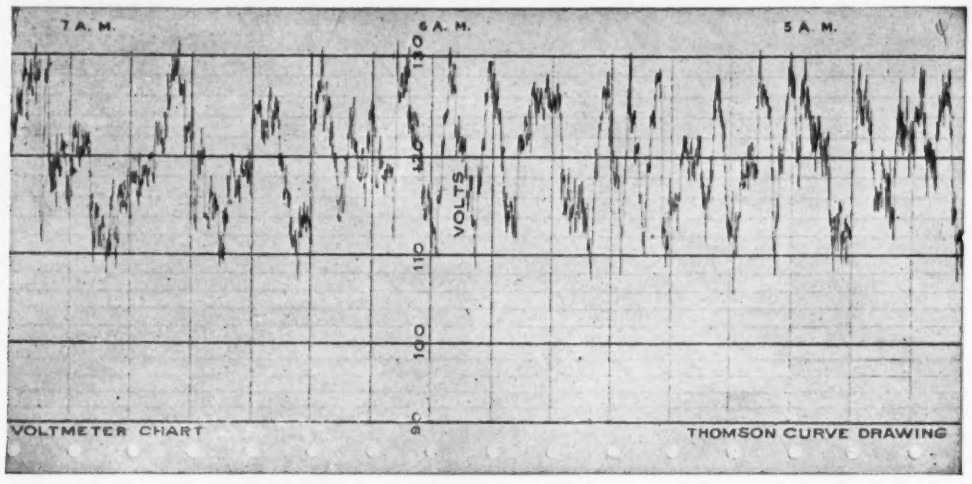


Fig. 1.—Record of Generator Voltage.

In both charts the clearly defined record given by the Thomson curve drawing instruments is well exemplified. The instruments used in taking these records were equipped with 20 to 1 ratio potential transformers. Therefore, the voltage variations illustrated represent the actual voltage regulation obtained at the lamps when the feeder circuit is 2,300 volts, since the ratio of transformation between the feeder circuit and the lighting circuit was the same as the ratio in the potential transformers, namely 20 to 1.

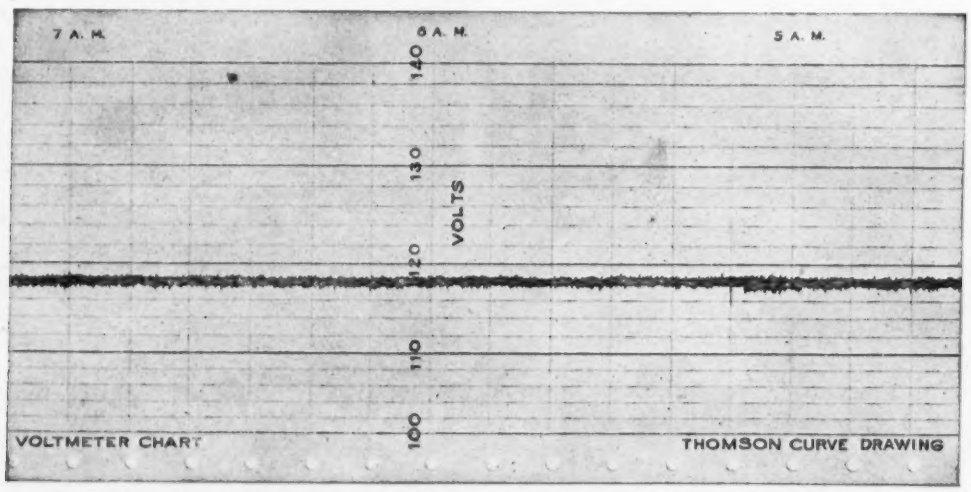
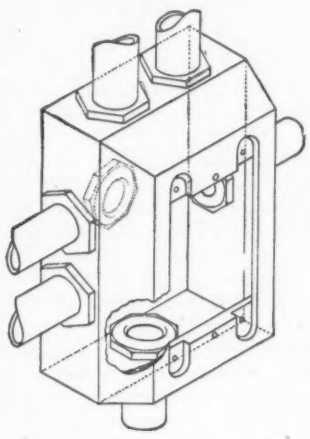


Fig. 2.—Record of Feeder Voltage.

The tests here recorded demonstrate the fact that a steady light can be obtained with incandescent lamps on a feeder circuit which also supplies electricity for heavy motor service. Not only will the regulators maintain a uniform illumination, but since the lamp voltage is practically constant the life of the lamp will be greatly increased.

Universal Switch and Junction Box.

The universal switch and junction box illustrated herewith, is designed for mounting flush switches or receptacles of any standard make where iron conduits are exposed on the exterior of walls. Any fitting such as snap switches, wall sockets, rosettes, bracket or pendant tubes may be substantially mounted on a universal lid which fits into the depressions shown in the face of the box. Flush switches or receptacles are fastened by their lugs to holes drilled and tapped for that purpose and the front of the box is beveled down to finish with the flush plates. There are seven ports for ½-in. conduit around which sufficient stock is left to permit of reaming for any larger sized duct, and these ports are sealed with a screwed disc so that if any are inadvertently removed they may be replaced so as not to render the box useless. The metal is made heavy to insure a perfect ground for conduits.

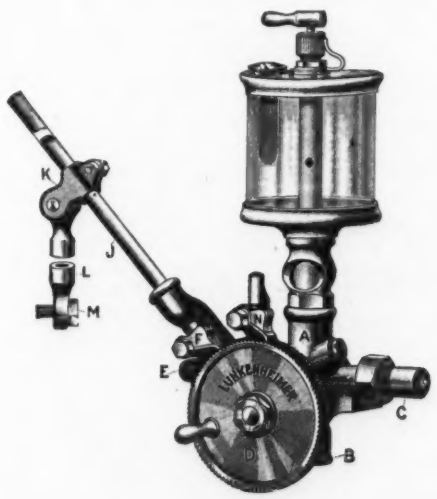


UNIVERSAL SWITCH BOX FOR EXPOSED IRON CONDUIT.

The above described box is manufactured by John L. Gleason, 290 South St., Jamaica Plain, Mass.

Mechanical Oil Pump.

The Lunkenheimer Company, of Cincinnati, is the manufacturer of the pump illustrated herewith, which they have given the trade name "Marvel." The driving mechanism is of the ratchet type, operated by the clutches that work co-operatively by the motion of the rod, which can be attached to the eccentric rod, or other moving parts of the engine by the couplings shown. The motion thus obtained is transmitted to the piston by the crank pin mechanism. The ratchet wheel is provided with a handle whereby it can be rotated by hand in case it is desirable to force a quantity of oil at any time, as for example in starting the engine. The coupling on the rod may be moved up or down, thus lengthening or shortening the stroke of the pump, and regulating the amount of oil fed by the pump, independent of the feed from the oil cup.



MECHANICAL OIL PUMP.

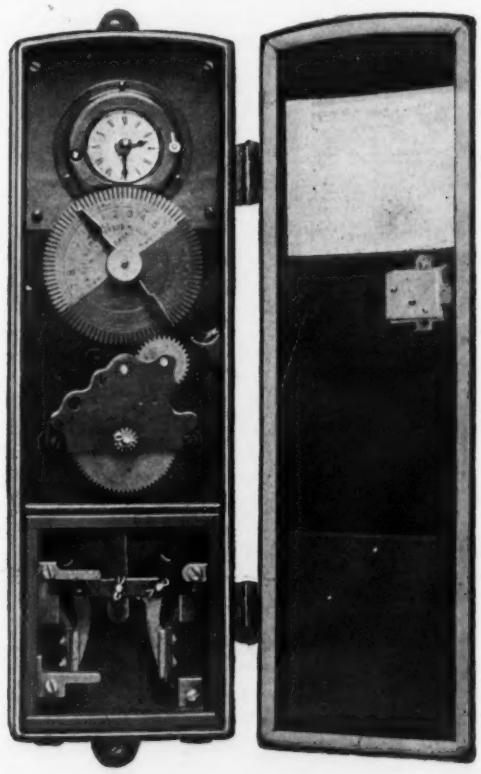
The joints of the cup are tight, the sight-feed glass being packed so as to prevent access of air that would have a tendency to cause the cup to feed after the engine had ceased running. This feature and use of check valves in the pump prevent wastage of oil supply. The feeding of oil is automatic, i. e., starting and stopping with the engine. The outlet is connected to the steam pipe or engine valve chest, and a spring check valve, supplied with the pump, should be placed in this connection as near as possible to the point of entry into the steam pipe or chest.

The bottom of the pump body is tapped with ⅝-in. bolt thread to receive a stand, so that it can be placed wherever desired. All parts are made to jigs and templets and are therefore easily renewed and interchangeable. The ratchet wheel, pawls, shaft and yoke are made of tool steel, tempered and hardened. All other metal parts about the pump are made of the very best bronze composition.

It is usually supplied with a Lunkenheimer No. 6, one pint capacity, "Sentinel," snap lever, sight feed cup. The filling hole is of large area, so as to fill easily. The cup is also fitted with a strainer and hinge cap which cannot be lost. Where pressure systems have been installed the pump is equipped with a Lunkenheimer "Reserve" pressure oil cup.

Automatic Time Switch.

In the automatic time switch illustrated herewith the switch is of the brush contact type and is operated by a toggle to minimize friction and render it constant. The switch mechanism is entirely separate from the clock, and each requires winding only once a week. The setting of the switch for operation at the desired time is done on a twenty-four-hour dial, by moving either of the pointers or hands on the dial, to the mark indicating the time for operation. The twenty-four-hour dial is divided in halves, of which one-half has light finish, indicating day, and the other dark finish, indicating night. The switch is arranged to operate every day in the week, but if desirable to omit operation on any one day, it can be fitted up with a simple device, which is provided with a separate dial and pointer. Operation may then be omitted by moving the separate pointer to the name of the day on which such omission is desired. A hand trip is provided for use when desired.



AUTOMATIC TIME SWITCH.

This time switch, which is particularly adapted for the operation of window, sign and street lamps, is made by the Albert & J. M. Anderson Manufacturing Company, Boston, Mass.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—In all branches of trade unabated activity is reported, and the volume of business exceeds all records. Crop and industrial reports are still almost uniformly favorable. An immense business is doing in the West and Northwest. Southern jobbing trade shows expansion, and inability to get adequate supplies of many lines of goods is the main subject of complaint at Eastern markets. September, like August, appears to be scoring heavy gains over the corresponding month a year ago. Official crop reports confirm previous advices of very large, if not record, yields, but price and traffic conditions are a bar to free movement. The scarcity of labor is still a subject of general complaint and cotton harvesting especially is being delayed in consequence of this. Collections are in the main rather easier, though a few South Atlantic markets note delay, due to cotton crop uncertainties. Prices of staples show great strength, all things considered, and are, in fact, at the highest level yet touched. Railway earnings are heavy, those for August gaining 13 per cent, a new high record for that month. More normal conditions obtain in the pig iron market, and buyers of foundry iron are more conservative. New business in steel rails comes from trolley lines and industrial roads, the volume being fair in the aggregate, while there are large inquiries on the market from foreign consumers; but our mills will hardly be able to take all the business. Contracts aggregating 35,000 tons have been placed for bridge-building material. Coke for prompt shipment commands premiums, but demand for future accounts is not so brisk. Coal is quiet, copper is higher, business is very large, and supplies are scarce, which causes a scramble for deliveries and prospects of higher prices. The scarcity of electrolytic for deliveries within the year is remarkable. None of the large producers is able to book anything of consequence in electrolytic or casting grades for October or November. Several of the larger producers are disinclined to book contracts for electrolytic deliveries beyond January at ruling prices. Lake and electrolytic are at 19c. to 19½ for round tonnages deliverable in December and January. Casting copper, thirty days, is 19c. to 19⅝. The business failures during the weeking ending Sept. 13, as reported by *Bradstreet's*, numbered 164, against 121 the previous week, and 188 in the corresponding week last year.

INTERNATIONAL STEAM PUMP.—The International Steam Pump Company's reports for the fiscal year ending March 31 show profits from the business of $2,255,312 as compared with $1,617,435 in 1905. This is an increase of $637,777. Income from other sources $68,177, a decline of $55,970 from last year's figures, and the falling off, of course, brings the total increase in income over last year down to $581,807. Interest, discount and other charges amounted to $128,693, an increase of $46,417, and the amount charged to depreciation was $344,952 against $326,371 last year. The surplus reported for the year is $747,795, which compares with a deficit last year of $17,961, with the addition of the previous surplus of $2,252,032 the total surplus is $2,999,827. From this sum $970,640 is charged off on account of plants dismantled, fixing the profit and loss surplus at $2,029,187, which is a decline, compared with the total reported last year, of $222,845. The income applicable to dividends on the common stock after liberal deductions for depreciation, etc., was 6.09 per cent, which compared with 2.35 per cent last year. Mr. John W. Dunn, president of the International Steam Pump Company, in his annual report to stockholders, in part says: "The year just closed has been one of uninterrupted operations and the output of the various shops has exceeded that of any year since the organization of the company. The orders booked during the year just closed are $1,275,000 in excess of the previous year, and the unfilled orders on the books of our company on March 31, 1906, amounted to $3,500,000. Satisfactory progress has been made in the development of the special lines such as centrifugal and turbine pumps and gas engines and notwithstanding the increased factory facilities it has been impossible to keep up with the requirements of the trade. There is also an increasing demand for larger units, especially the surface condensers, which has taxed the maximum output of our shops. Since organization there has been expended $7,160,000 on new buildings, machinery and tools, as a result of which the production has increased 60 per cent over the first year. The outlook for the coming year is very promising. The orders for the year far exceed the orders for the same period last year."

RECENT SALES OF ALLIS-CHALMERS GAS ENGINES.—With the advance into favor of the large gas engine unit for power production, the time has come when the hitherto enormous wastes of by-product gases from coke ovens and blast furnaces are to be eliminated. Some idea may be had of the power wasted in escaping gases when it is considered that a modern blast furnace, similar to those used by the Carnegie Steel Company, with a capacity of 23 tons per hour, will furnish sufficient gas to supply over 15,000 hp continuously; then if 250 hp per ton of pig produced per hour is used for blowing engines, pumps, etc., there is about 10,000 hp available for outside power. The United States Steel Corporation is naturally the largest single operator now undertaking the utilization of waste gases. The Carnegie Steel Company early in the year inaugurated this modern practice in the Pittsburg District by an order placed with one manufacturer alone, the Allis-Chalmers Co., for 12,000 hp in gas-driven blowing engines, and 2,000 kw in a gas-driven electrical generating unit. The Illinois Steel Company, within the same period, has placed orders for 8,500 kw in gas engine electrical units for the South Chicago and Bay View Works, Milwaukee. The Indiana Steel Company, whose great new plant at Gary, Ind., promises to eclipse any producing mill ever built, in size of output and excellence of equipment, has ordered 14,000 kw in alternating and 4,000 kw direct-current gas engine generating units. The National Tube Company has on order an Allis-Chalmers horizontal twin tandem gas engine, direct connected to a 1,000-kw generator. The Trenton Iron Company, of Trenton, N. J., has also ordered a 300-kw unit. Among recent orders received for smaller engines is a second unit ordered by the Pittsburg Plate Glass Company, for installation at Kokomo, Ind. It consists of a standard horizontal tandem gas engine, direct coupled to a 300-kw Allis-Chalmers direct-current generator. The first unit ordered by this company was a 1,000-kw unit to be installed at the new Crystal City, Mo., plant. The American Steel & Wire Company, of Cleveland, will also equip its plant with an Allis-Chalmers horizontal, twin tandem engine, direct connected to a 1,000-kw engine type generator.

CONSUMPTION OF COPPER.—The consumption of copper in the electrical field naturally excites a good deal of interest, and various figures find publicity on the subject. A few of these were given in this department a couple of weeks ago. A well-informed correspondent remarks in regard to that "guess" as follows: If it was intended to produce a list of consumers of copper, including primary and secondary consumers—and meaning by "secondary" those who procure from the primary consumers such things as bare wire, copper sheets, tubes, etc., for the purpose of converting or advancing the same into other products—such as insulated wire, copper kettles, or electrical apparatus, then the names are perhaps correct so far as they go, except that they do not include at least two of the "largest consumers," and the list would be misleading because the amounts put down for the second, third and fourth parties include copper in one form or another, which also appears in the "consumption" of some or all of the remaining parties. A list constructed on the first theory, would probably read as follows: American Brass Company, 125,000,000 pounds; Standard Underground Cable Co., 70,000,000 pounds; Jno. A. Roebling's Sons Co., 60,000,000 pounds; National Conduit & Cable Co., 50,000,000 pounds; American Steel & Wire Co., 40,000,000 pounds; General Electric Co., 30,000,000 pounds; Westinghouse Electric & Manufacturing Company, 20,000,000 pounds; Western Electric Company, 20,000,000 pounds, making a total of 415,000,000 pounds.

OTIS ELEVATOR BUSINESS.—At the meeting of the directors of the Otis Elevator Company they did not make a declaration of a dividend on the common stock, although an increased dividend in this issue was promised in the annual report of the president last March, in which he said: "If the company's business continues as prosperous as now indicated, it is the intention of the directors to place the common stock on a 3 per cent basis, payable 1½ per cent semi-annually, the first payment on this basis to be made October 15." The company has been paying 2 per cent each spring, and this payment for the current

year was made last April. One of the reasons for the falling off in the company's position, it was said, has been the San Francisco disaster. The Pacific Coast business of the Otis Elevator Company has been a very large part of the whole, and the damage to the principal city of the coast has made heavy inroads into the income from this source. New construction, however, it is expected, will more than offset the present stagnation. At the meeting the regular dividend of 1½ per cent for the quarter was declared on the preferred stock, and the promise made last spring of an additional issue of preferred to supply funds to replace the large outlay of working capital made in the last year for new plants and extensions was carried out. Out of the $772,000 of preferred stock in the treasury, $609,000 will be offered at par to holders of both the common and preferred issues in the proportion of one share of the new stock for every twenty outstanding. The subscription rights will begin September 27 and close October 3.

RECENT STURTEVANT ORDERS.—The popularity of the new Sturtevant enclosed engine, with forced lubrication and watershed partition, is shown by recent sales, among which may be included the Jeanesville Iron Works Company, Hazelton, Pa.; Mutual Wheel Company, Moline, Ill.; Rand-Avery Supply Company, Boston, Mass.; Wood Worsted Mills, Lawrence, Mass.; W. W. Gleckner & Sons Co., Canton, Pa.; MacArthur Bros. Co., Glen Lyn, Pa.; Thomas & Smith, Chicago, Ill. Forge exhaust and blast apparatus, furnished by the B. F. Sturtevant Co., of Boston, Mass., is being installed by the Morse Twist Drill & Machine Company, New Bedford, Mass.; Brown & Sharpe Manufacturing Company, Providence, R. I.; Providence Technical High School, Providence, R. I.; C. B. Hutchinson, Lyndonville, Vt.; Lynn Manual Training School, Lynn, Mass. The equipment of the modern hospital or asylum is to-day not considered complete without a ventilating system under absolute control, in which a positive acting fan works continuously and furnishes air in regulated volume. Among buildings to be so equipped may be enumerated the following, of which the B. F. Sturtevant Co. is to furnish the apparatus on recent orders: Old Ladies' Home, Harrison, N. Y.; Jersey City Hospital, Jersey City, N. J.; New York Hospital, New York City.

EXPORTS AND IMPORTS.—Mr. A. P. Austin, chief of the Bureau of Statistics of the Department of Commerce and Labor, has compiled figures on the total value of imports and exports of the United States for the first eight months of the year ending Aug. 31. These show the vast growth of foreign trade over previous years and give some idea of the prosperity prevailing. The value of imports, free and dutiable, for the first eight months of the year is placed at $845,540,383, an increase of $75,255,185 over the same period of last year. The exports were valued at $1,098,994,662, an increase of $132,427,103. The balance of trade in our favor is $253,454,279, and an increase of $57,171,918 over the same period of 1905. The imports of gold for eight months ending in August were $80,308,039, and the exports $33,512,040, the excess being $46,795,999. These figures do not, of course, take any account of the $19,000,000 or $20,000,000 of gold imported this month under Secretary Shaw's ruling. Imports of silver for the eight months named were $29,693,485, and exports $41,847,028, an excess of exports of $12,153,543. The nine leading staple crops of the country, excepting hay, indicate a value of $2,898,720,000 or $130,740,487 more than in 1905. Final estimates may carry this even higher.

WELSBACH ANNUAL REPORT.—The Welsbach Co. report for the year ended May 31, 1906, is as follows:

	1906.	1905.	1904.	1903.
Gross	569,907	541,469	524,162	555,542
Depreciation	36,629	17,283	12,701	13,121
Balance	533,278	524,186	511,461	542,421
Int. on bds.	326,300	326,300	326,300	326,300
Sinking fund	105,360	105,360	105,360	105,360
Net profit	101,618	92,526	79,800	110,761
Dividends	70,000	70,000	70,000	70,000
Surplus	31,618	22,526	9,800	40,761

It will be noted that the gross is slightly more than in 1903, when it was only $14,500 less.

RUBBER MONOPOLY.—A special cable dispatch from London, of September 14, quotes Mr. Symington, of the firm of William Symington & Co., which has just sold out to the United States Rubber Company, as asserting that the American company has not created a monopoly by the purchase, and that it does not aim to gain control of the world's supply of crude rubber. "Hitherto," said Mr. Symington, "the American company has done all of its purchasing and banking in Europe through agents. The directors considered that in view of the development of the company's business it would be more economical for them to have their own European headquarters, and the deal concluded with my firm makes this possible."

OIL ENGINE PLANT.—The borough of Kutztown, Pa., after operating a municipal lighting plant for some time is increasing its capacity by the installation of a 125-hp "Hornsby-Akroyd" oil engine. The present plant consists of a 65-hp "Hornsby-Akroyd" oil engine belted to generator. Both engines supplied by the De La Vergne Machine Company, New York.

RUST BOILER WORKS.—The S. Jarvis Adams Foundry Company and the Rust Boiler Company of Pittsburg have secured sites at Midland, Pa., and will begin the erection of plants close to the furnaces of the Midland Steel Company of Pittsburg. Both plants will be in operation within four months, and nearly 800 workmen and their families will be taken there.

CHICAGO PNEUMATIC TOOL.—The Chicago Pneumatic Tool Company reports that the month of August was the best in the history of the corporation, with the heaviest output. The record was made both in business booked and in shipments made, the latter exceeding all previous monthly reports by 15 per cent.

Financial Intelligence.

THE WEEK IN WALL STREET.—The course of the stock market during the past week has been one evidencing continued activity and optimism, but with some shadow of doubt as to the course of money. Up to the present time America seems able to control supplies from Europe, but there are evidences of resistance on that side to further drain, and should the demand there become accentuated for any reason the pinch on this side might be quite serious, especially as the current needs for industry and for moving the crops are so persistent. In general every condition justifies a broad and strong market and the larger dividend payments have, of course, done much to strengthen quotations. Prices have, however, enjoyed so continuous an advance and have reached so high a scale it is difficult to consider them capable of much further advance, while the prices of most commodities have also been maintained at a high level for an extraordinarily long period. In view of the magnitude of the crops and the activity in all lines of trade the opinion is freely expressed at the beginning of the fall season that the period of prosperity ahead is in no wise inferior to that which has been enjoyed during the past three or four years, although it is likely, of course, to receive the usual check as the period of the presidential election is approached. Electrical stocks of all kinds have shared in the general strength and the prices subjoined show a maintenance of current prices. A good deal of interest is taken in the market in the new issue of securities by the Western Union Telegraph Company, and there is every reason to believe that these will be easily and readily ab-

NEW YORK

	Sept. 11	Sept. 18		Sept. 11	Sept. 18
Allis-Chalmers Co.	16¼	18	General Electric	166	166
Allis.Chalmers Co. pfd.	41¾	44⅛	Hudson River Tel.	...	...
American Dist. Tel.	25	25	Interborough Rap. Tran.	...	...
American Locomotive	71⅛	76⅛	Mackay Cos.	73¼	72¼
American Locomotive pfd.	112¼	113⅛	Mackay Cos pfd.	71⅝	70⅝
American Tel. & Cable	90	91	Marconi Tel.	...	..
American Tel. & Tel.	138	134	Metropolitan St. Ry	...	...
Brooklyn Rapid Transit	80¼	80⅛	N. Y. & N. J. Tel.	...	...
Electric Boat	15	15	Western Union Tel	91	89¾
Electric Boat pfd	60	60	Westinghouse com.	147	151
Electric Vehicle	13	12	Westinghouse pfd.	...	...
Electric Vehicle pfd.	18	18			

BOSTON

	Sept. 11	Sept. 18		Sept. 11	Sept. 18
American Tel. & Tel.	138⅛	136	Mass. Elec. Ry. pfd	...	73⅜
Cumberland Telephone.	..	...	Mexican Telephone	4	5
Edison Elec. Illum.	...	...	New England Telephone	130	129
General Electric	...	...	Western Tel. & Tel	...	...
Mass. Elec. Ry.	...	20	Western Tel. & Tel pfd.	...	88

PHILADELPHIA

	Sept. 11	Sept. 18		Sept. 11	Sept. 18
American Railways	50⅜	51¼	Phila. Electric	8¼	8⅛
Elec. Co. of America	11¾	11¾	Phila. Rapid Trans.	28⅞	29⅛
Elec. Storage Battery	70	70	Phila. Traction	...	90
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Sept. 11	Sept. 18		Sept. 11	Sept. 18
Chicago City Ry.	160	165	National Carbon.	85	85
Chicago Edison	143	...	National Carbon pfd.	119	119
Chicago Subway.	53	52	Union Traction	...	...
Chicago Tel. Co.	...	110	Union Traction pfd	...	...
Metropolitan Elev. com.	27	28			

sorbed. In Boston there has been a good deal of surmise over a possible increase in the dividend on the Bell stock, but nothing definite appears to be known. Following are the closing quotations of September 18:

THE ALLIS-CHALMERS MEETING has already been noted in this department. Subjoined is the official report just received: The annual meeting of the stockholders of the above company, held in Jersey City, September 6, was marked by an unusually large attendance, more than 65 per cent. of the entire capital stock having been represented. The general feeling of harmony and satisfaction that prevailed in support of the present administration was particularly noteworthy. The re-election of Mr. W. H. Whiteside to the presidency, and his election to the directory to fill the longest term in the gift of the company, assures a continuance of his aggressive policy and will eliminate any feeling of uncertainty for some years to come. In the following unanimous resolution the feeling of satisfaction felt by the stockholders is strongly expressed: Resolved, "That the stockholders in annual meeting assembled express their appreciation of the services of President Whiteside and assure him of their cordial support for the ensuing year." It is noticeable that the company has secured about $4,500,000 worth of orders for classes of machinery not hitherto manufactured by this company, and this amount would have been very largely augmented had the completion of the improvements and extensions of the West Allis plant not been delayed by the labor troubles to which the contractors erecting the new buildings have been subjected. Notwithstanding the fact that the volume of orders taken for Allis-Chalmers steam turbines has been beyond all expectation, the demand for Reynolds Corliss engines also shows an unprecedented increase over preceding years. In the electrical field the large orders received have hastened the occupancy of the new shops at West Allis provided for this branch of the business, which, in spite of their unfinished condition, are already in partial operation. Some of the largest corporations in the country have awarded the Allis-Chalmers Co. contracts for their complete power and electrical equipments, thus endorsing President Whiteside's policy in providing the new departments established during the past year, which now enables the Allis-Chalmers Co. to take orders for complete installations and thereby save purchasers the losses and annoyance incident to the division of responsibility in the erection and operation thereof. The acquisition by the company of the Christensen Air Brake and Compressor patents rounds out the list of products required to enable the Allis-Chalmers Co. to enter the electric railway field fully equipped for that service. Mr. Whiteside's report to the stockholders was supplemented by a verbal statement covering the equipment of complete power plants and the work of the following departments: Electrical, steam engines and hoists, steam turbine, hydraulic turbine, air brake, pumping engine, gas engine, mining machinery, steam shovels and dredges, crushing and cement machinery, flour mill, saw mill, timber preserving machinery, power transmitting machinery.

NEW WESTERN UNION BONDS.—A special meeting of stockholders of the Western Union Telegraph Company has been called for Oct. 10, the date of the regular annual meeting, to authorize an issue of $25,000,000 convertible 4 per cent bonds. Of the new bonds, it is planned to issue only $10,000,000 at present, which will supply funds for the construction of new lines and wires and for the purchase of new property. The bonds are to be convertible at par, and will make necessary the issue of a corresponding amount of stock. In the call for the special meeting the directors explain that since the general consolidation in 1881 of the companies now composing the Western Union, and down to June 30, 1905, the company has expended for construction and the purchase of new property $39,074,066. Of this sum, $23,755,060 has come out of net earnings, $13,319,000 from the sale of $20,000,000 real estate bonds over the amount required to pay off old bonds, and $2,000,000 from stock sold in 1897. "During the last few years," it is said, "the rate of growth of the business and the consequent demand for increased facilities have been greater than during the previous years, and the expenditures for construction and new property have correspondingly increased. All of the $20,000,000 4½ per cent bonds authorized in 1900 have been issued; $6,681,000 were required to redeem maturing 6 and 7 per cent bonds, $2,076,500 were issued to pay for new property and construction prior to June 30, 1899, and $11,242,500 were issued for similar purposes since that date. The quarterly statement of the company issued recently shows a decrease of net revenue for the quarter ending Sept. 30 (partly estimated) of $7,593 compared with last year. The figures are $2,000,000 net revenue for 1906 and $2,007,593 for 1905. The actual returns for the quarter ended June 30, 1906, were: Net revenue, $1,740,634; bond interest, $334,075; balance, $1,406,559; dividends, $1,217,022; surplus, $189,537; previous surplus, $16,659,192; total surplus, $16,848,729.

COMMERCIAL CABLE COMPANY OF CUBA.—This company is being organized by The Mackay Companies to lay two cables from the United States to Cuba to compete with the Western Union cables, which now have a monopoly of that business. Forty years ago the Spanish Government granted that monopoly to hold good for forty years, and the forty years expire on December 6th, 1906. The Mackay Companies proposes to be ready to compete for the business upon the expiration of the monopoly. The plan is to lay two cables from Havana to Key West, and thence from Key West to Florida, and to provide special wires from Florida to New York City, so as to give rapid and reliable service. Mr. Mackay hopes to have the system open for business on December 7th, 1906, the day after the monopoly expires. The new line will be operated in connection with the Postal Telegraph and Commercial Cables. The certificate of incorporation of the Commercial Cable Company of Cuba was filed September 12 at Albany. The names of the incorporators are Clarence H. Mackay, William W. Cook, Albert B. Chandler, Dumont Clarke, Samuel S. Dickenson, George Clapperton, and Albert Beck, who are also the directors.

B. R. T. ANNUAL.—Gains of more than $2,000,000 in gross and more than $1,500,000 in net earnings are shown in the annual report of the Brooklyn Rapid Transit Cmpany. For the twelve months ended June 30 the gross earnings amounted to $18,473,328, compared with $16,333,444 in 1905. The net earnings were $8,031,951, compared with $6,529,574. Fixed charges were larger by $534,442 than they were in 1905. The balance after the payment of fixed charges and taxes was $2,742,952, as compared with $1,603,218 in 1905. The directors appropriated $580,343 for betterments and additions; this is $127,058 more than was appropriated for similar purposes in the year before. The surplus, after deducting these charges, was $2,162,609, an increase of $1,012,676 over the surplus reported for the previous twelve months. The surplus previously reported, as adjusted by the deduction of various items, amounted to $984,723, making a total surplus of $3,147,332. From this there was deducted for discount on bonds and for contingent reserve fund and other items $1,071,770, leaving $2,075,562 to the credit of the profit and loss account.

ELECTRICAL TRADES EXPOSITION.—The annual meeting of the stockholders of the Electrical Trades Exposition Company was held in Chicago, on Tuesday, Sept. 11, 1906, for the purpose of electing directors for the ensuing year. The following directors were elected: Samuel Insull, Charles E. Gregory, G. H. Atkin, Stewart Spalding, Ellsworth B. Overshiner, George B. Foster, T. P. Gaylord, Homer E. Niesz, H. B. McMeal, W. W. Low and J. P. Cracraft. At a meeting of the board of directors immediately following the stockholders' meeting, the present officers were all re-elected, as follows: Samuel Insull, president; Ellsworth B. Overshiner, vice-president; Charles E. Gregory, vice-president; John J. Abbott, treasurer; Stewart Spalding, secretary. Managing Director Homer E. Niesz reported over 80 per cent of the floor space in the main exhibit hall of the Coliseum already contracted for at the second annual exposition to be held January 14-26 next.

DIVIDENDS.—The directors of the Cincinnati Street Railway Co. have declared the regular quarterly dividend of 1½ per cent. The directors of the Columbus Gas Light & Fuel Co. have declared a quarterly dividend of 1¼ per cent. The directors of the Western Union Telegraph Company have declared the regular quarterly dividend of 1¼ per cent, payable October 15. The Canadian General Electric Company has declared a quarterly dividend of 2½ per cent on the common stock, payable Sept. 20. The directors of the Duluth Edison Electric Co. have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable Oct. 1, 1906. Directors of the Cumberland Telephone & Telegraph Co. have declared the regular quarterly dividend of 1¾ per cent, payable Oct. 1. The directors of the Tri-City Railway & Light Co. have declared a quarterly dividend of 1½ per cent on the preferred stock.

ELECTRO-MAGNETIC TRACTION.—A deficiency judgment for $239,109 has been docketed in New York City against the Electro Magnetic Traction Company in favor of Theodore W. Siemon, trustee for the bondholders of the company. The assets of the company, consisting of patents rights in contracts, etc., were sold at auction on July 17 by Thomas P. Dineen, referee, for $3,000, and the purchaser was the Westinghouse Electric & Manufacturing Company.

GENERAL NEWS.

Construction News.

PRESCOTT, ARIZ.—A municipal lighting plant is to be established here.

LONG BEACH, CAL.—The question of constructing an electric light plant is reported under consideration.

GRIDLEY, CAL.—The citizens are considering the question of municipal ownership and operation of the electric lighting system in this city.

SACRAMENTO, CAL.—Edgar M. Sheehan and others representing the California Traction Company, have asked for a franchise for an electric railway on the M Street road.

LOS ANGELES, CAL.—City Attorney J. Perry Wood has declared that all contracts with the lighting company are void, and that a municipal plant will soon be installed.

LOS ANGELES, CAL.—The Edison electric plant at the corner of Alhambra and Avenue 21, will be greatly enlarged and improved, and costly machinery will be installed.

GRASS VALLEY, CAL.—The question of constructing a municipal electric light plant is under consideration. If constructed it is proposed to establish a plant which will also furnish the city with water; probable cost, $80,000.

SANTA CRUZ, CAL.—The three electric light and gas systems of Santa Cruz and Watsonville have sold their plants to the Coast Counties Light & Power Company. The new consolidated company will be styled the Co-operative Light Company.

PALO ALTO, CAL.—General W. H. H. Hart states that he is arranging to build an electric railway from Stanford University to San Francisco, and will eventually extend the line to Monterey. He has secured a franchise in Palo Alto and is now seeking one from the University authorities and in Redwood City.

OAKLAND, CAL.—A resolution has been passed by the City Council that the Central Pacific Railway Company be granted permission to lay down and maintain a spur track from the termination of its tracks south of Fifth Street between Poplar and Kirkham Street along Fifth Street northerly to a point 62.5 feet west of the western line of Poplar Street.

SACRAMENTO, CAL.—The Sunset Telephone Company is remodeling its whole system of lines, planting new poles, stringing wires, etc. At a meeting of the Board of Supervisors the application of Dr. E. V. Jacobs for a franchise to build and operate a telephone line in Sutter County came up. S. G. Jackson, of Glenn County, ran the bid up to $1,500, and the Supervisors were about to award him the franchise when he left the room, and failing to return in a reasonable time, the board accepted the bid of the Sunset Telephone Company for $1,000.

SAN JOSE, CAL.—The Peninsular Railway Company is constructing a double track electric railway connecting Los Gatos and San Carlos, a distance of 50 miles. The company has recently purchased the line known as the San Jose & Los Gatos Railway Company, an electric line 28 miles in length running from San Jose to Los Gatos and to Saratoga Springs. The Peninsular Company has purchased a right of way through the Santa Clara foothills to the grounds of Stanford University and thence to San Carlos, and has announced its intention of constructing a road from this point which will ultimately reach San Francisco.

LOS ANGELES, CAL.—A consolidation has been effected of the Ventura Water, Light & Power Company, the Oxnard Light & Water Company and the Santa Paula Electric Company, and a new concern has been formed, known as the Ventura County Power Company, with a capital stock of $2,500,000, for power generation and transmission purposes. Service will be obtained by tapping the Edison Company's wires at its Castain plant at Kern River. Major Driffill, superintendent of the Oxnard sugar factory, is president of the new corporation. The directors are: J. A. Driffill, of Oxnard; J. S. Torrance and W. R. Stoats, of Pasadena; J. H. Adams, T. W. Phillips and J. R. Martin, of Los Angeles, and C. C. Teague of Santa Paula.

FLORENCE, COL.—A contract has been let to a Denver firm to double-track the Denver & Rio Grande from here to Canon City.

UNIONVILLE, CONN.—The Union Electric Light & Power Company has just installed a new water wheel and dynamo of greater capacity than the two already installed in the plant.

MERIDEN, CONN.—The Meriden Electric Light Company is intending to enlarge its plant on South Colony Street very materially in the near future by the addition of a large steam turbine which will give the company much needed additional power. The engine will be installed in a few weeks and will be of 700 hp.

WILLIMANTIC, CONN.—The city committee on the street lighting contract has signed the contract as it was empowered to do several months ago. The new contract is for five years, and the price is $92 per arc light per year. There are at present one hundred in operation, and the Willimantic Gas and Electric Light Company can now go ahead and make the changes in its circuits, etc., which will be necessary to provide the extra lights which will be called for. When the company gets things in shape one hundred and fifty lights can be operated.

WINDSOR LOCKS, CONN.—Mr. Parker Kemble, of Boston, who is to be the general manager of the electric light and power plants at Thompsonville and Windsor Locks, will, until the consolidation of the two plants is effected, divide his time between the two towns. It is understood that the Thompsonville plant will be used only as a sub-station and that current will be furnished from a greatly increased plant at Windsor Locks. It is expected that the change will be effected within the next few months. It is also reported that the present system of contract lighting will be done away with and meters installed.

WALLINGFORD, CONN.—At a special meeting of the voters for considering the advisability of adding to the electric lighting plant, it was voted to appropriate $8,500 for extending and enlarging the plans and to issue bonds to raise $5,000 of the amount, the same to be payable a year from date of issue. Although it was voted to appropriate $8,500, thus making the total amount available for the improvements $14,000, the electric commissioners stated that it was very probable that the total expenditure would not exceed $12,000. The extensions to the plant will consist of a water wheel, generators and other appliances.

WASHINGTON, D. C.—Bids will be received until Oct. 2 by D. W. Ross, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing motor-generator set line material, fire alarm telegraph system, etc.

WASHINGTON, D. C.—Bids will soon be asked for a second time for the construction of the $1,300,000 power plant in Garfield Park, which will supply light, heat and power to all the Government buildings on Capitol Hill. J. G. White & Company have been appointed consulting engineers.

WASHINGTON, D. C.—Bids will be received until October 9 at the Bureau Supplies and Accounts, Navy Department, Washington, D. C., to furnish a quantity of electrical supplies at various navy yards as follows: Incandescent lamps, bells and buzzers, testing sets and generators, Gonda cells, dynamotors, switches and receptacles, thermostats, conductor, cable, etc. Applications for proposals should refer to Schedule 147. H. T. B. Harris, Paymaster General, U. S. N.

MIAMI, FLA.—The Florida East Coast Electric Light & Water Company has decided to enlarge its electric plant. J. N. Macgonigle is superintendent.

SUMTERVILLE, FLA.—Steps have been taken to organize the Tropical Telephone Company with headquarters at Bushnell. Lines will be built connecting all towns in Sumter County, and will be extended to Ocala. The company is capitalized at $10,000. Mr. Henry Bevill will be general manager. It is expected to have the plant ready by Christmas.

TALLAPOOSA, GA.—The new electric lighting system was put into operation Sept. 10, and is giving satisfaction.

CARTERSVILLE, GA.—Bids will be received until Sept. 20 by the Mayor and Aldermen for $40,000 electric light, gas and water works improvement bonds. Paul Gilreath is Mayor.

BOISE, IDAHO.—Bids will be received until September 25 for installing a heating, lighting and pumping plant at the Idaho State Penitentiary. W. H. Tipson is secretary board of trustees.

CAPRON, ILL.—Capron Home Telephone Company has increased its capital stock from $3,000 to $10,000.

METAMORA, ILL.—Mayor Irving and other citizens are interested in the construction of a gas or electric light plant.

MATTOON, ILL.—The City Council has authorized the lighting committee to purchase a new dynamo and 125 new lamps, to cost in all about $5,700.

GALESBURG, ILL.—A new interurban company, headed by J. F. Porter, has been formed for the purpose of building an interurban line which will extend from the tri-cities to Galesburg, Ill.

CHICAGO, ILL.—The Chicago Telephone Company has bought a tract at the northeast corner of South 41st Avenue, to establish a division headquarters there, with a barn and large storage warehouse.

DE KALB, ILL.—The De Kalb-Sycamore Interurban Traction Company is building a line in this direction. The plan is to run through Boone, DeKalb, McHenry, Kane, Ogle, Lee, Kendall, La Salle and DuPage Counties.

PORTLAND, IND.—Announcement is made of the early building of a traction line between here and Celina, Ohio.

CARLISLE, IND.—The Board of Town Trustees of this place has granted a franchise to Thos. C. Grizzle and Chas. W. Lisman for an electric light plant.

CAMBRIDGE CITY, IND.—The town board of this city has closed a deal for the control and title of the electric light plant now owned by the Cambridge City Light & Power Company. It is the purpose of the city to improve the plant and install some new machinery.

COLUMBIA, IND.—The electric light committee has instructed J. E. Spicer, superintendent of the municipal electric lighting plant, to correspond with electrical supply firms for prices for repairs to the machinery and putting the plant in order for the winter.

SOUTH BEND, IND.—F. A. Bryan, vice-president and general manager

of the Berrien Spring Power & Electric Company, writes that the proposed work contemplated in connection with the development of water power on St. Joseph River, near Berrien Springs, will cost about $1,000,000.

COVINGTON, IND.—The water and electric light plant burned to the ground on Sept. 13, and the city is without light and water. E. H. Nebeker and H. C. Yunt, president and secretary respectively, and alsc principal owners, announce that a new and modern plant will be built and equipped at once. The company is in the market for material and machinery.

VINCENNES, IND.—Eugene Rush, president of the White River Hydraulic Company, which proposes to construct a power dam in White River and install a hydraulic electric plant, is seeking a franchise to furnish this city with arc lamps at $53 a year. The city is at present paying $63. Mr. Rush is also securing contracts in cities and towns within a radius of fifty miles.

DURANT, I. T.—At a meeting of the business men of Sterrett with capitalists from Georgia and Mississippi, contracts were signed in which the town of Sterrett deeded to the proposed Oklahoma Central Interurban Railway 323 acres for the purpose of building an interurban railway from Sterrett to Kemp, thence to the new Oklahoma Central, which is now in construction in Red River bottoms. I. S. Murray, the promoter from Alabama, states that it is the object of the company to extend the line when completed from Sterrett to Sulphur, thence to Marietta, and that the movement is supported by Chicago capitalists.

MASON CITY, IA.—A new power plant will be erected here, 106x171 feet, which will be the largest ever erected by the Cowham system.

FORT DODGE, IA.—A movement is on foot to install an electric railway from Fort Dodge to Homer. H. L. Corbin and R. G. Pierce, of Homer, are interested.

DAVENPORT, IA.—The new owners of the Tri-City Railway Company have started a force of 50 men to work on the double track on Fourth Avenue east of Twentieth Street.

MUSCATINE, IA.—Estimates for the cost of the interurban line between here and Davenport have been completed, and according to these the outlay will be in the neighborhood of a million dollars.

VINTON, IA.—S. S. Lichty and others have secured control of the Benton County & Vinton Telephone Company and will make improvements. Considerable cable work will be installed and all lines will be made metallic circuit.

INDEPENDENCE, KAN.—Work has begun on the Independence-Coffeyville interurban line.

COFFEYVILLE, KAN.—W. M. Nees has been granted a franchise for the Union Traction Company of Kansas to build through this city.

PITTSBURG, KAN.—F. V. Crouch has completed the preliminary survey of the interurban line from Iola to Pittsburg. From Erie the line takes a diagonal cut to St. Paul. From there it will strike the half-section line that passes through the north part of town and will go straight on that line to the north side of Girard. From Girard the line will run diagonally southwest through the Radley Camp and Dunkirk to Frontenac, and thence due south to Pittsburg.

WOLCOTT, KAN.—The loss of the Kansas City-Western electric line at Walcott, Kan., when its power house was destroyed by fire recently, is estimated at between $40,000 and $50,000. The car barn and twelve cars it contained were saved. The property destroyed consists of four large engines, three generators, six transformers and large storage batteries. Two transformers and one big generator were just added to the plant to increase the power for additions and changes in the road to decrease the time between Leavenworth and Kansas City. The company was about to double the size of the power plant, however, and most of the new machinery is now on the ground. This will be placed in a temporary power house at once and in ten days the company hopes to have enough power of its own to operate the line. The Wolcott power house was built in 1899. It was a brick structure with two stories and a basement. The ground dimensions were 86x176 feet.

HOPKINSVILLE, KY.—The Hopkinsville Gas & Electric Company has reorganized, with A. B. Connable, of St. Louis, Mo., president; L. M. Shepard, Hopkinsville, manager, and T. L. Marshall, Hopkinsville, superintendent. New machinery will be installed.

NAPOLEONVILLE, LA.—The town authorities are getting busy on the question of electric light for the town. At a regular meeting it was decided to employ a consulting engineer and get plans and specifications for the proposed plant.

FREDERICK, MD.—Contracts will soon be awarded by the Washington, Frederick & Gettysburg Electric Railway Company for grading the new road. The first link will be built between Frederick and Lewistown. A power house will be built near Catoctin Furnace and an amusement park will be laid out the foot of the mountain near Yellow Springs.

LOWELL, MASS.—The Lowell Electric Light Company is enlarging its distribution system and has petitioned for the right to set 111 more poles.

HANOVER, MASS.—The Electric Light & Power Company, of Abington and Rockland has petitioned for a franchise in Hanover. L. A. Crossett is president.

ABINGTON, MASS.—The Abington & Rockland Electric Light & Power Company is to extend its service to Hanover. A survey has been made for the location of the poles.

HATFIELD, MASS.—The Amherst Gas Company has secured a franchise to erect poles and string wires in Hatfield for electric lighting purposes. D. Barry is manager.

CAMBRIDGE, MASS.—The 4,000-hp engine of the Cambridge Electric Light Company broke down on September 13 and will be out of commission two or three months for repairs.

NORTH ADAMS, MASS.—Extensive plans for the rebuilding of the Hoosac Valley Street Railway are under consideration, and it is expected that they will be carried into effect at the opening of next spring.

BEVERLY, MASS.—The Beverly Gas & Electric Company has received permission from the State Board of Gas & Electric Commissioners to issue $200,000 bonds for additions to its plant. A Macauley is superintendent.

CAMBRIDGE, MASS.—The special committee of the Cambridge City Council on the municipal ownership of the local gas and electric light plants submitted its report last night. The majority report was against the city taking the plants.

SALEM, MASS.—Three of the four electrical motors and pumps for the sewerage pumping station have arrived, the station is nearly completed and the electrical equipment is nearly all in place. The Salem Electric Lighting Company will furnish the electricity for operating the station.

SPRINGFIELD, MASS.—The United Electric Company has recently finished the work of burying its wires underground along South Main Street, from State Street to Mill Street, or 1½ miles of wires. This was done of the company's own volition. During the present year to date the company has put from three to four miles of its wires underground.

JACKSON, MICH.—The long-talked-of new electric road from Jackson to Detroit will become a reality.

ONTONAGON, MICH.—The Victoria Copper Mining Company has decided to construct a dam on the west branch of Ontonagon River, near Bergland, for water power purposes.

FLINT, MICH.—The Fenton Light & Power Company, the recently reorganized company which took over the Fenton Gas and Electric Plant, has filed notice of a mortgage for $50,000 to the Detroit Trust Company, to cover an issuance of bonds to make improvements in the plant.

HOLLAND, MICH.—The Grand Rapids & Holland Railway Company is delivering the ties on the ground for a double track from Ottawa and Sixteenth Streets as the "middle switch." It is planned to make this improvement this Fall. The company has purchased sufficient land for a private right of way the entire length of Ottawa Street, and the track on that street at present in use will be abandoned.

ST. JOHNS, MICH.—A committee composed of Horace Gage, George S. Corbit, Richard Davies and Frank Farnham has been appointed by President Byron Danley, of the St. Johns Business Men's Association, to secure $15,000 and right of way over the proposed route as St. Johns' share for the proposed Detroit, Saginaw & Grand Rapids Electric Railway. Maple Rapids will raise a similar amount, and work will be commenced as soon as the $30,000 is pledged.

LAPEER, MICH.—Williams & Smith, of the Lapeer Gas & Electric Company, have applied to the Council for a franchise to operate a street car system.

GRAND RAPIDS, MICH.—Mayor Ellis is considering the question of street railway extensions. The Grand Rapids Railway Company will not extend its tracks, as this would require a new franchise. If the Railway Company ever accepts a new franchise, it lays itself open to the municipal ownership clause of the charter, which would give the city the right to take over the lines of the company at the expiration of the franchise. So far only one solution has appeared. It is to amend the charter and take out the ownership clause; then grant the company a new franchise for the extensions which will expire on the same date as the present franchise. The street railway company has expended $360,000 this year in replacing worn rails.

TWO HARBORS, MINN.—F. E. Evans, village recorder, writes that the Crowley Electric Company, of Duluth, has secured the contract for machinery and appliances for the electric light plant, at $4,050.

WATERVILLE, MINN.—Otto Neitge, of Mankato, has received the contract for the construction of the new building of the Cannon Valley Telephone Company.

SAUK RAPIDS, MINN.—Another step has been taken in the promulgation of the proposed plan for a big dam and water power plant at Sauk Rapids, to be constructed by the Sauk Rapids Water Power Company, of which A. G. Whitney is the real working head.

KANSAS CITY, MO.—A permit has been issued to the Metropolitan Street Railway Company for the remodeling of the power house at Fifteenth and Walnut Streets. The work will cost $14,000.

KANSAS CITY, MO.—The Metropolitan Street Railway Company was granted a franchise by the Independence City Council to extend the southern end of its cross town line east on Forest Avenue to the fair grounds.

JACKSON, MISS.—Application has been filed with the secretary of state for a charter for the Claremore Railroad Company, which will build an electric railway from this city to Clinton and Cooper's Well, a popular resort 16 miles from this city.

MEXICO, MO.—The preliminary survey on the proposed electric line from this city to Perry, Ralls County, has been started.

ST. LOUIS, MO.—A new substation is being built at a cost of $65,000 for the Union Electric Light & Power Company on Morgan Street and Vandeventer Avenue.

MAPLEWOOD, MO.—The streets of Maplewood, part of St. Louis, are to be lighted again, after having been dark for three months. The Maplewood Improvement Association at a recent meeting, accepted a proposition from the Suburban Light & Power Company, by which sixty-nine street lights are to be provided at a cost of $15 a year. Each lamp is 32 cp incandescent. The lamps are to be paid for by the residents of the streets lighted, instead of by a blanket contract as formerly.

PRINCETON, N. J.—Plans are being prepared by Wilson, Harris & Richards, of Philadelphia, Pa., for the erection of a large power house for Princeton University.

CAMDEN, N. J.—The street committee of the City Council has received an application from the Bell Telephone Company, asking permission to lay conduits in and along certain streets in the city with a view of burying all its wire.

KEARNY, N. J.—The Public Service Corporation has secured the contract for lighting the streets for 5 years from Aug. 1, 1906, at $85 per year for arc lamps of 2,000 c. p. and $15 per lamp per year for incandescent lamps of 32 c. p.

ROCKAWAY, N. J.—Runyon & Carey, engineers, have submitted to the Mayor and Council their report on the plant of the Rockaway Electric Light & Improvement Company, which the town is considering purchasing. They estimate the value of the plant at $14,252, and recommend improvements to same, at an additional cost of $10,316.

BOONTON, N. J.—The Morris County Traction Company has accepted the forty-year franchise granted it by the Common Council of this borough. The franchise covers the Boonton end of an extension to run from Danville, where connections will be made north to Rockaway, Dover, Wharton, Mine Hill, Kenvil and Succanna, and south to Morris Plains and Morristown.

NEWARK, N. J.—The Newark Block Lighting Company, of which James M. Seymour, Jr., is president, has applied to the board of public works for permission to lay conduits through Market street for the purpose of supplying electricity in the business district of the city. It is stated in the petition that the company will charge eight cents per kw-hour for electricity; a system of discounts in the payments of bills within five days is also provided for. The company also offers to give the city ten per cent of its gross receipts.

GENEVA, N. Y.—A trolley line is to be built from here to Erie, Wayne County, via Phelps.

NEW YORK, N. Y.—Acting Mayor McGowan is formulating plans for the establishment of a city lighting plant to cost between $500,000 and $750,000.

FULTON, N. Y.—The Oswego River Power & Transmission Company has petitioned Council for a franchise for electric lighting, heating and power purposes.

TROY, N. Y.—At the meeting of the Common Council application was received from the United Traction Company for a franchise for the extension of its tracks in the North end of the city.

BROOKLYN, N. Y.—Bids will be received until Sept. 26 by Bird S. Coler, borough president, for furnishing and setting lighting fixtures in the Gates Avenue Court House, Borough of Brooklyn.

NEW YORK, N. Y.—Bids will be received until Sept. 24 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric equipment in School 90, Borough of Manhattan.

MIDDLEPORT, N. Y.—Attorneys representing the Buffalo, Lockport & Rochester Railway Company applied to Justice Pound recently for an order awarding them immediate possession of a strip through the middle of the cemetery of St. Stephen's Roman Catholic Church Society at this place.

ROCHESTER, N. Y.—The City Lighting Contract has been let to the Rochester Railway and Light Company for a period of five years, beginning with July 1, 1907. The contract provides that the city shall pay $57.95 a year for the lamps most in use, $62.96 a year for double arc lamps on iron poles and $68 for single arc lamps on iron poles.

OGDENSBURG, N. Y.—The Ogdensburg Power & Light Company, of Ogdensburg, has filed with the State Gas and Electric Commission an application for consent to issue $100,000 bonds to secure a debt of approximately that amount incurred in the improvement of the property.

FRANKFORT, N. Y.—The Board of Trustees have granted the Hudson River Electric Power Company permission to construct a transmission line through this village. The transmission line will allow the company to deliver power according to a contract that had been entered into with the Pratt Chuck Works.

PEEKSKILL, N. Y.—The Putnam & Westchester Traction Company is planning soon to build an electric railway from Peekskill to Cortlandt and Oregon, in Putnam Valley, a distance of about four miles. Power will be obtained from the Peekskill Lighting & Railroad Company. J. S. Ladd, of Peekskill, is president of the company.

WADDINGTON, N. Y.—The New York & Ontario Power Company, of Waddington, St. Lawrence County, in the purchase of the electric power rights at Waddington and in the development of this valuable power plant, expects to expend $3,500,000 and to have a property valued at from four to five millions. The plant will develop 30,000 hp. David Crichton is president.

ALBANY, N. Y.—The Paul Smith's Electric Light & Power & Railroad Company has been authorized by the State Railroad Commission to build an electric railway about nine miles long through the Adirondacks from Lake Clear Railroad station in the town of Harrietstown, Franklin County, to Paul Smith's, at Saranac, with a branch from the main line to Upper St. Regis landing. The company was incorporated by Paul Smith and others some time ago, and has a capital of $100,000.

CORTLAND, N. Y.—The terms for a new lighting contract for five years have been decided upon by the Common Council and Edwin Duffey of the Traction Company. The lamps are to be lighted every night in the year and all night. The contract price is to be 24 cents per arc, while the price to private consumers is dropped from 12 cts. per kw-hour to 11 cents. The lamps will be enclosed arcs. The price of arc lights under the present contract is 28½ cts. per night. The change in street lighting will occur Jan. 1, while the private rates will go into effect Oct. 1.

LITTLE FALLS, N. Y.—The contract to light the streets of Little Falls for a period of five years, commencing January 1, has been awarded to the Herkimer County Light and Power Company. This is the company that is at present lighting the city at the rate of $85 per lamp per year. The company now agrees to supply alternating-current arc lamps for a period of five years at $35 per lamp per year for 125 lamps or as many more as may be desired, and 125 incandescent lamps at $12 per year each, and as many more at the same price as may be desired. The above prices were accepted although, as noted in these columns recently, the Hudson River Electric Power Company submitted slightly lower bids.

CONCORD, N. C.—Louis A. Brown, one of the incorporators of the Concord Realty Company, announces that definite steps will soon be taken looking to the building of a local and suburban electric line, at least seven miles long, touching a number of nearby cotton mills.

RALEIGH, N. C.—United States Circuit Court Judge T. R. Purnell has at last signed the order for the sale of the Buckhorn Falls Power Company, at Raleigh, N. C., after the sale has been advertised four successive weeks at the court house door of Chatham County, Pittsboro, N. C., where the sale will occur. The contract for completing this big plant will be sold with the rest of the plant, the mortgage debt being $350,000, purchaser to pay one-third cash, one-third in six months, and one-third in twelve months, or by securing deferred payments he may take possession and use the first mortgage bonds at 65 per cent. of face value including coupons.

FARGO, N. D.—Bids will be received by the County Commissioners of Cass County, until Oct. 2nd, for the furnishing and installing of apparatus including piping or wiring for a lighting plant of 100 lamps, to be installed ready for use at the County Hospital of Cass County. Arthur G. Lewis, County Auditor.

CLARINGTON, O.—The Home Telephone Company has increased its capital stock from $5,000 to $30,000.

MAHONINGTOWN, O.—The right of way for a trolley line from here to Morado park has been secured, and plans for the construction of the line are now being considered.

AKRON, OHIO.—It is reported that bids will be received until Sept. 27 by the Board County Commissioners for installing a heating, power and lighting plant for the court house and jail. Mark D. Buckman is county auditor.

MARIETTA, OHIO.—The Marietta Telephone Company will spend $65,000 in enlarging the local plant, and will also put in 100,000 feet of cable in Marietta. The telephones now in use will be removed and new ones will be installed.

LORAIN, OHIO.—The Bell Telephone Company is preparing to establish an exchange in Lorain. It has a grant but has never operated under it, and this city, which now has 25,000 inhabitants, is dependent wholly upon the independent service.

OTTAWA, OHIO.—After considering figures from the local company for the illumination of Water Works Park, the village council has decided to install its own lighting plant in the park. This is probably the entering wedge for the establishment of a municipal plant to illuminate the entire town.

BRIDGEPORT, OHIO.—Stockholders of the Wheeling Traction Company have voted favorably on a proposition to guarantee the bonds of the Bellaire & Southwestern Railway and the Wheeling & Western Railroad to the amount of $1,000,000. These new lines are under construction on the Ohio side of the river.

CINCINNATI, OHIO.—Isaac Bates and associates, who are interested in a number of factories near the village of Brighton, have applied for a franchise to lay a single-track line to connect with the Baltimore & Ohio Railway near Spring Grove. It is the intention to switch cars to the various factories in this district, using an electric locomotive for power. The work is to be commenced within three months and completed within fifteen months.

MANSFIELD, OHIO.—The Mansfield & Southern Traction Company is being formed by G. A. Bartholomew, Thomas W. Latham and others, of Cleveland, who have been interested in the promotion of several electric lines in Ohio. It is proposed to build a line from Mansfield to Mount Vernon, touching Lexington, Bellville, Butler and Frederick. The promoters have been promised assistance from these towns. A party of engineers is now at work on three routes.

CINCINNATI, OHIO.—Cincinnati and New York people are behind a project for utilizing the power of the Cumberland River in Kentucky and transmitting electric power to this city. Arthur Gieslo, of New York, a consulting engineer, has completed a survey of the route from Lexington. A large dam will be built across the river backing the water to Williamsport 25 miles away, thus making a reservoir holding 2,000,000,000 cu. ft. of water. The project, it is said, will involve an expenditure of over $2,000,000.

CINCINNATI, OHIO.—Mr. Louis Dolle, who is prominently identified with the Little Miami Light, Heat & Power Company, states that excellent progress is being made in the work of securing water rights along the Little Miami river in the vicinity of Lebanon. The company expects to build several dams in this vicinity and the privilege of erecting these has been granted by the commissioners of Warren, Clermont and Hamilton Counties. A number of manufacturing concerns are planning to erect plants in the vicinity as soon as the company is in position to supply power.

AKRON, OHIO.—Thomas R. Brooks, of Scranton, Pa., who is said to represent Pittsburg capitalists, has applied for a 50-year franchise to build and operate a heating and electric lighting system in Akron. The ordinance specifies 3 cts. per lamp per hour, not exceeding 500 watts, as the maximum charge for each street arc lamp. The city at present pays the Northern Ohio Traction & Light Company 2¾ cts. per lamp per hour. The present contract with the traction company will not expire for two years and no contest for the public lighting privilege can be made until then. If the company secures its grant it promises to begin work on its power station and system within one year.

DAYTON, OHIO.—The Dayton Lighting Company began on Sept. 1 to supply Nernst lamps free to customers in the down town section of the city. The company has a large number of these lamps installed and is meeting with very pleasing results with them. The work of installing the company's underground conduit system will be finished by the middle of October. The work, which was started last fall, involved the laying of 1,000,000 duct feet of 3½-inch vitrified clay conduits with about 150,000 feet of service laterals, 300 manholes and 410 service boxes. G. M. Gest, of Cincinnati, is doing the underground work. Both alternating and direct current will be supplied to customers in the district mentioned. The Dayton Lighting Company recently started its new 4,000-hp Allis-Chalmers-Bullock turbine.

OKLAHOMA CITY, OKLA.—The Oklahoma City Street Railway Company is arranging to extend its line on Main Street westward to Clark Avenue, north to Second Street, and thence westward to Ohio Avenue, which runs along the river front.

OREGON CITY, ORE.—Mr. Withycombe, brother of the recent candidate for governor, has been acquiring water power privileges in the vicinity of Stone, Clackamas County.

DALLAS, ORE.—Connection has been made between Dallas, Monmouth and Independence from the electric power and light plant in Dallas, under the management of C. B. Rhodes, resident manager for the Williamette Valley Company. This line will be extended to Albany as an emergency line for Albany, Independence, Monmouth and Dallas. In case of accident to the plants either in Albany or Dallas, the other end can furnish the current.

PITTSBURG, PA.—The Pittsburg Railways Company is pushing forward as rapidly as possible the work of bonding the water mains near its power houses to prevent electrolysis as required by the department of public works. It is expected that this work will be complete before cold weather comes.

NEW WILMINGTON, PA.—J. H. Veasey, of New Wilmington, says the New Castle & New Wilmington Interurban Railroad Company will begin work on its proposed line in six months. Right of way has all been secured, and the work of organizing the company will be perfected within a few months.

GILBERTON, PA.—The Town Council has awarded the contract for lighting the borough streets to the Frackville Light, Heat & Power Company for a period of ten years. The company will supply 24 magnetite arc lamps for $60 per lamp per year and open arc lamps for $70 per lamp per year, a reduction of $25 per lamp from last year. The company also agrees to furnish twenty 16-cp lamps free of charge.

PITTSBURG, PA.—A mass meeting of the taxpayers of West Liberty borough has been held to protest against the street lighting contract made by councils with the Allengheny County Light Company for 75 arc lamps at $70 each a year. The citizens assert that while 75 lamps are insufficient to light the borough properly the contract would necessitate a per capita tax of $1.37 to maintain. Resolutions were passed protesting against the contract and requesting the council to permit the Southern Light, Heat and Power Company to demonstrate the lighting power of the Nernst lamp.

PITTSBURG, PA. — With only two charter applications "hanging fire," the Pittsburg Subway Company claims to be in a position to go ahead with the construction of an underground system of railways for Pittsburg as soon as franchises are granted to it by Councils. Two more charters were obtained yesterday, one for the Lawrenceville Street Railway Company and the other for the Rebecca Street Railway Company, the lines proposed to be "feeders" for the main system. The two charters yet to be obtained are for the Kelly Street Railway Company and the Hay Street Railway Company. It is believed these will be obtained soon.

POTTSVILLE, PA.—The Eastern Pennsylvania Railways Company, which has in contemplation the making of extensions and improvements to aggregate, it is said, $1,000,000, has decided upon some of the new work to be carried out. For one thing, it is planned to build the extension from Pottsville and Shenandoah, and from Middleport to Tamaqua. The construction of this new line will be pushed vigorously so that a through line can be established between Pottsville and Mauch Chunk at an early date. With the completion of the Pottsville Shenandoah section, practically all of the electric railways in Schuylkill County will be linked together, forming a connected system of more than 100 miles of track under two managements as at present. This system is divided into two principal groups of railways. Pottsville and Mauch Chunk are terminals of the Southern portion, while Mahanoy City and Shamokin are terminals of the Northern portion. Between Mauch Chunk and Shamokin the extreme Eastern terminus and the extreme Western terminus will be a distance of 75 miles as surveyed. The system belonging to the Eastern Pennsylvania Railways Company will be rearranged as regards the supply and distribution of power for railway and lighting purpose. In the district where there are now half a dozen old power plants there will probably be substituted two new modern plants.

SENECA, S. C.—W. F. Austin, Mayor, writes that the question of issuing bonds for water works and an electric light plant is under consideration.

ROCK HILL, S. C.—The citizens are considering the municipal ownership and building of an electric light plant. The present lighting contract expires July 1, 1907.

COLUMBIA, S. C.—Work on the new electric line from Columbia College through the property of the North Columbia Land Company has been commenced. The new line will extend two miles from the terminus of the Columbia College line.

WATERTOWN, TENN.—H. H. Weir and W. L. Goodhart have secured a franchise for an electric light plant.

MEMPHIS, TENN.—It is proposed to build a telephone line along the levee from Memphis to Walnut Bend. Mr. H. N. Pharr is the engineer in charge.

McEWEN, TENN.—Mr. Shingleton, of the Consolidated Electric Company, of Nashville, has closed a deal with L. D. Baker for a dynamo and all fixtures for a plant. It will be 60-kw machine, 220 volts, direct current. The pole line is being constructed.

MEMPHIS, TENN.—Eleven cars of electrical equipment for the Merchants' Power Company have arrived in Memphis and are being unloaded and placed in position at the power house of that company, which is in course of construction, at Keel Street and the Illinois Central Railroad. This shipment represents one-third of the machinery necessary to operate the plant, as some twenty-five other cars are en route, and are being expected daily. The shipment which has already been received includes two engines of 2,000 horsepower each and two 2,000-hp boilers, while two other engines and two other boilers of the same size are yet to come. The plant is to be in operation prior to January 1, 1907.

TEXARKANA, TEX.—The Texarkana Telephone Company is planning to build a line between here and Shreveport.

CELESTE, TEX.—Carver Bros., of Farmersville, are interested in the construction of water works and an electric light plant at Celeste.

FORT WORTH, TEX.—The Northern Texas Traction Company is asking for two franchises, one for lines in the down town district and the other on South Side streets.

BEAUMONT, TEX.—The American De Forest Wireless Telegraph Company has announced its intention to erect a station at this place as soon as a suitable site is secured.

SALT LAKE CITY, UTAH.—Assistant General Manager Wautland of the Flagstaff Company, together with Edward Heckman, of Philadelphia, are said to be interested in the construction of an electric railroad for freight and passengers from Alta to Murray.

BURLINGTON, VT.—The Brattleboro Street Railroad and the gas and electric light plants have been transferred to the Twin State Gas & Electric Company, of Hartford, Conn. This company, it is reported, is to secure control of twelve companies of a similar kind in this State, New Hampshire and Maine.

RICHMOND, VA.—The Henrico Board of Supervisors have given the Virginia Power & Passenger Company a ten-year franchise to build a road on the boulevard from Broad Street to the new fair grounds on the north side of the Richmond, Fredericksburg & Potomac Railroad.

WINCHESTER, VA.—The Winchester & Washington City Railway Company, Winchester, Va., is developing a 3,000-hp hydraulic plant with the intention of supplying electricity to Winchester and Berryville, Va., and Charlestown, W. Va. Later on the company will probably construct an electric railroad.

CHELAN, WASH.—J. T. McChesney, of Everett, is reported interested in the development of the Chelan River water power.

RAYMOND, WASH.—The South Bend Electric Company has petitioned for a franchise for an electric light and heating system in Raymond. R. Kennedy is manager.

GOLDENDALE, WASH.—The Goldendale Telephone & Telegraph Company has increased its capital stock from $3,000 to $12,000.

BELLINGHAM, WASH.—The plant of the Columbia Improvement Company at Nooksack Falls is nearly completed and will be ready to supply electricity to the city of Bellingham by Oct. 1.

CHEHALIS, WASH.—General Manager A. C. Sands, of the Sunset Telephone Company, met with the Centralia Council last week and signified the intention of the company to remodel its lines in that city and Chehalis.

BREMERTON, WASH.—The County Commissioners have granted a franchise to the Northwestern Long Distance Telephone Co., to use certain of the county roads between Port Gamble and Kingston for term of 50 years for telephone and telegraph purposes.

SEATTLE, WASH.—A new cable is to be laid in Alaskan waters connecting Ketchikan, Wrangell and Hadley with the outside world. The cable ship is expected to do the work some time next month, and not

over a week or ten days will be occupied if the cable ship encounters good weather, as she may be expected to do at that time of the year.

SPOKANE, WASH.—H. M. Dewey, of Spokane, manager of the Q. S. Gold Mining Company, of Okanogan County, states that 35,000 hp will be developed in that county on the Sinlahekin River. The company will also construct an electric railway 35 miles long through the county and will erect a smelter near Conconully. Electricity will also be developed for lighting purposes and operating mines. About 5,000 hp will be developed at first.

TACOMA, WASH.—In an effort to obtain an advantage over the Farmers' Telephone Company, the Pacific States Telephone & Telegraph Company is offering at Wenatchee to furnish telephones to farmers through the Wenatchee Valley at $1 a year. Prior to the organization of the Farmers' Telephone Company, the charge for telephones outside of the city limits of Wenatchee was fixed at $2.50 a month. Later this was dropped to $1.50 to compete with the Farmers' system. The latter company now has entire control of the local service, its system covering the entire valley. The company began business two years ago with a capitalization of $10,000. This was soon increased to $50,000, and another increase is contemplated in the near future.

OCONTO, WIS.—The Oconto Electric Company is contemplating building a new plant in this city.

WAUSAU, WIS.—The Wausau Electric Company has increased its capital stock from $75,000 to $150,000. R. E. Panker is president.

SUPERIOR, WIS.—The Council has under consideration the question of purchasing the water and power plant owned by the Superior Water, Light & Power Company.

OCONTO, WIS.—The Oconto Electric Company is contemplating build- the contract for installing a Westinghouse generator, switchboard and other apparatus for the municipal electric light plant.

CHEYENNE, WYO.—The Rocky Mountain Bell Telephone Company has put a force of men at work in Cheyenne on improvements to be made in the telephone system here, which will entail an expenditure of about $75,000, when completed. The material for the new lines has nearly all arrived in the city and the work of making the extensive changes planned has already begun. The improvements include a common battery system, several miles of cable and a new switch board in the central exchange, the latter alone costing several thousand dollars and has been made to order.

WOODSTOCK, N. B.—The Town Council has authorized the Water and Light Committee to procure bids for pump and motor; also for a dynamo, generator, lamps and other necessary apparatus for a lighting system.

ST. MARYS, ONT.—The by-laws to advance $40,000 towards building an electric railway from St. Mary's to Embro was carried by a large majority last week.

GRAVENHURST, ONT.—W. H. Cross, town clerk, writes that bids will be received on Sept. 25 for the construction of water works and an electric light plant; probable cost, $40,000. T. T. Simpson, of Ottawa, is engineer for the hydro-electric power plant.

HAMILTON, ONT.—The contracts for the construction of the Brantford & Hamilton Electric Railway have been awarded. Electrical supplies will be furnished by the Canadian Westinghouse Company, of Hamilton. The railway company has opened offices in the Chancery Chambers and the following officers have been appointed: I. K. Pierson, chief engineer; Elmer T. Haines, secretary; J. W. Nesbitt, solicitor, and Miss Agnes Geddes, treasurer.

NIAGARA FALLS, ONT.—It is stated that the Ontario Power Company has decided to proceed at once with the completion of the first section of its development plant. Three more generators, with turbines to run them, have been ordered and will be installed as soon as received, capable of producing 12,500 hp each, being duplicates of generator No. 4, now installed in the power house, which is the largest machine of its kind in the world. There are now four generators in the company's power house, and when the three new ones are installed, the available space will be all occupied and the seven units will take all the water now available to run them.

MEXICO CITY, MEX.—The Mexican Light & Power Company, Ltd., has purchased the electric light and power system owned by S. Roberto y Cia, which has been serving a number of suburban towns. The consideration was $70,000. It is announced that the system will be greatly improved and enlarged.

GUADALAJARA, MEX.—United States manufacturing concerns have been awarded contracts for equipment and construction material aggregating $500,000 by La Electra, S. A., the Spanish Light, Power and Street Railway Company, of Guadalajara. This company is constructing one of the most extensive and up-to-date electric railway systems in Mexico.

PUEBLA, MEX.—H. E. Matton, chief engineer of the Puebla, Atlixco & Metepec Electric Railway Company, states that he has located the first 15 miles of the line and that the most difficult engineering tasks have already been accomplished. The line between Puebla and Atlixco will be about 22 miles long. The work of construction will be begun next month.

SULTEPEC, MEX.—The Sultepec Electric Light & Power Company is installing a large hydro-electric plant at Temascaltepec. Power will be supplied to the mines and mills at that place and also be transmitted to the towns of Sultepec, Los Arcos, Mina de Agua and other places in that region. The persons who are interested in this project also own the Toluca Electric Light and Power Company at Toluca.

New Industrial Companies.

THE LEWIS ELECTRIC LIGHT COMPANY, of Grand Rapids, Mich., has been organized with a capital stock of $15,000. The company will deal in electrical apparatus and supplies.

THE STAR ELECTRIC STAGE LIGHTING COMPANY has been formed in New York City, with a capital of $3,000. The directors are O. W. Behrendt, Attorney Hawkes and W. H. Wood, of New York.

THE LOMBARD-REPLOGLE ENGINEERING COMPANY, of Akron, O., has been incorporated, with $100,000 capital stock by M. Otis Hower, Nathanial Lombard, E. R. Held, Mark A. Replogle, Harvey Y. Hower and A. J. Bertram. They will engage in the manufacture of a water wheel governor. The factory will be located in Akron.

GILLETTE-WIBBER COMPANY.—A certificate of incorporation has been filed by the Gillette-Wibber Company, of New London, Conn. The company will manufacture and conduct a general electrical business. The amount of the authorized capital stock is $20,000, divided into 200 shares of the par value of $100 each, and the company will start business with that amount.

THE ELECTRICAL INSULATOR MANUFACTURING COMPANY, of Barberton, Ohio, is being formed, with a capital stock of $100,000. The capital will be furnished by Akron, Barberton and Cincinnati people. The company will manufacture high-voltage porcelain insulators and third-rail insulators. The plant of the Barberton Pottery Company will be purchased and fitted up for the work within the next thirty days. A. L. Dyke, who was formerly in the insulator manufacturing business at East Liverpool, will be in charge of the mechanical end of the company's business.

New Incorporations.

CHICAGO, ILL.—The Chicago Street Railway Company, with a capital of $5,000, has been incorporated by Harry Goodman and others.

STARKVILLE, LA.—The Starkville Street Railway Company has been incorporated with a capital of $30,000, by C. E. Ard and others.

HARTFORD, CONN.—The Twin City Gas & Light Company has been incorporated with a capital of $1,700,000 by Wm. Wherry, Jr., and Harold G. Villerd.

HIGGINSONVILLE, MO.—The Boland Telephone Company has been chartered at Higginsville, Mo., by N. J. Dyer, S. S. McCullough and others, with a capital of $3,125.

CELIA, NEB.—A new independent telephone company has been organized here, with $3,000 capital stock. The incorporators are J. F. Hammerberg, L. M. Aldridge and others.

WESTFIELD, ILL.—The Westfield Electric Light and Power Company has filed articles of incorporation with a capital of $20,000. The incorporators are Thos. H. Gardner and others.

BREESE, ILL.—The Peoples Telephone Company, of Breese, has been incorporated with a capital stock of $15,000. The incorporators are Benjamin H. Donne, B. J. Lagan and W. G. Bechtold.

MONMOUTH, ILL.—Application has been made for the incorporation of the Moline, Rock Island & Eastern Railway Company, which proposes to build a line from Carbon Cliff through Rock Island and Moline to Galesburg.

PURCELL, IND. TER.—The Hobart Light & Power Company, of Purcell, has been incorporated, with a capital of $550,000, by Fred A. Gale, of Chicago, Ill. Geo. S. Seldon, of Erie, Pa.; Dorset Carter, of Purcell, and others.

SANTA MARIA, CAL.—The Home Telephone & Telegraph Company of Santa Barbara, has been incorporated to establish a telephone system in Santa Maria. The capital is $200,000, with $10,000 paid in. Those interested are Paul O. Tietzin and Robt. E. Easton, of Santa Maria.

DOVER, DEL.—The Juneau Mining & Power Company has been incorporated to engage in mining and milling and to develop power. The incorporators of this concern are Alfred I. Rogers, Burdette S. Bontrajer and G. B. Winsor, all of Pittsburg. The capital stock is $1,000,000.

LANSING, MICH.—The Jackson, Ann Arbor & Detroit Railway Company, capitalized at $1,900,000, has filed articles of association with the secretary of state. W. A. Boland, of Jackson and New York, is stated to be the chief stockholder. The object of the company is to build or acquire and operate an electric railway from Jackson to Detroit.

DUQUOIN, ILL.—Articles of incorporation of the Duquoin Rapid Transit Company have been filed for record. The company is capitalized at $30,000, and proposes to construct a line from Belleville to Duquoin. The president of the line is J. Pope, president of the Duquoin Bank. A number of Eastern capitalists are behind the project.

BELLEVILLE, ILL.—Articles of incorporation of the Belleville & Pinckneyville Traction Company has been filed for record. L. T. Turner, John A. Hamilton, William Stevenson, T. P. Armstrong and George F. Mead are the incorporators; capital stock, $100,000. The company proposes to construct an electric line from Belleville to Pinckneyville.

AUGUSTA, ME.—The Ash Meadows Water Company, organized at Portland for the purpose of owning, developing and operating water power and privileges in the States of Nevada and California, filed its certificate of incorporation here to-day. The authorized capitalization is $5,000,000.

James C. Kipp, of Piston, Pa., is named as president, and Edwin H. Sleafer, of Scranton, Pa., treasurer.

EVANSVILLE, IND.—Articles have been filed with the Secretary of State for the incorporation of the Evansville & Cannelton Traction Company, which is to operate between the two places. The capital stock is $10,500, and the following are the directors: F. W. Cook, George A. Cunningham, Charles C. Tennis, C. H. Battin, Gus Muhlhausen, M. S. Sonntag and M. B. Harper.

SAN FRANCISCO, CAL.—The Western Power Company has been incorporated, with a capital of $18,000,000, to finance the Feather River water power project. It is also reported to have control, through purchase of stock or option rights, of the Eureka Power Company, and the Golden State Power Company. F. H. Ray, of the American Tobacco Company, and A. C. Bedford, of the Glucose Trust, are reported to be among the directors.

LOS ANGELES, CAL.—Articles of incorporation have been filed for the Los Angeles & Owens River Railway, with a capital stock of $10,000,000, of which $360,000 has been subscribed. The incorporators and directors are William J. Hunsaker, A. M. Chaffey, S. P. Jewett, George Chaffey and George B. Reeve. The company proposes to build and operate an electric railroad from the head of the Owens River valley into Los Angeles, a distance of 328 miles.

FORT WORTH, TEX.—The Citizens' Railway & Light Company which was incorporated recently under the laws of Texas with $1,000,000 authorized capital stock, will take over the Citizens' Light & Power Company, the Arlington Heights Street Railway and the Fort Worth & Rosen Heights Street Railway, which were recently purchased by a syndicate headed by Cleveland interests. Warren Bicknell, the president of the new company, is from Cleveland. The incorporators are: Warren Bicknell, J. F. Harper, J. R. Nutt and E. W. Christy, of Cleveland; W. O. Allen, of Fostoria; Carey B. Close, of Toledo; George E. White, Sam Rosen, C. E. Montgo, of Fort Worth.

GRAND RAPIDS, MICH.—The Boyne River Power Company has filed articles of association with the Secretary of State. The capitalization is placed at $100,000, all of which is subscribed. The company will acquire the flowage rights on the Boyne River owned by E. A. Stowe and C. C. Follmer, and will erect a 32-foot dam three miles east of Boyne City, utilizing power to light Boyne City, where the company already has a steam power electric plant. The company will furnish power to Boyne Falls, Clarion and the resorts on Walloon Lake. Frederick C. Miller will manage the company and headquarters will be in Boyne City. Work on the construction of the dam will be started at once.

EMINENCE, KY.—Articles of incorporation of the Henry County Light & Power Company, which have been filed with the County Clerk, mark the taking over of the old Eminence Electric Company by the new company, in which New York capitalists are the largest holders of stock. The capital stock is $40,000, which is divided into 400 shares of a par value of $100 each. The maximum debt of the company is limited to $50,000. The plant is in operation now, supplying light and power to Eminence. It is expected that sooner or later Henry County interests will buy up the chief interests in the company. The incorporators and their holdings are: C. B. Hole, of W. N. Coler & Co., New York, 200 shares; J. J. Borger, who is managing the plant and who lives in Eminence, three shares; C. C. Hieatt, H. M. Johnson, of the firm of Johnson & Hieatt, of Louisville, 197 shares.

Company Elections.

MOBILE, ALA.—The Mobile Electric Company, which was formed recently to take over all of the electric power and lighting interests in Mobile, has elected the following officers: President, Theodore K. Jackson, of Mobile; vice-president and treasurer; J. J. O'Brien, of Chicago; secretary, James S. Cummings, of Chicago.

MANCHESTER, N. H.—At the annual meeting of the stockholders of the Manchester Traction, Heat & Power Company, held Sept. 14, the following directors were elected: William A. Tucker, S. Reed Anthony, W. M. Parker, P. L. Saltonstall, J. Brodie Smith, George H. Hood, R. G. Sullivan, Charles M. Floyd, Stillman F. Kelley, B. P. Larned, R. H Hallowell and W. Parker Straw. W. Parker Straw succeeded to the vacancy caused by the death of Harry E. Parker. The directors elected Mr. Tucker president, Mr. Smith vice-president, and Mr. Anthony, treasurer.

MOKANE, MO.—At the annual meeting of the stockholders of the Mokane-Tebbetts-Fulton, Telephone Company was held this afternoon, the company was reorganized. The following officers were elected: R. Earle Hodges, president; E. C. Holman, vice-president; J. W. Ratekin, secretary; T. F. Hafner, treasurer. Board of Directors: Theo. Beaven, G. W. Stallard and Wm. Hornbuckle. This is one of the few independent telephone lines in central Missouri which has resisted repeated efforts to purchase the stockholders' interests. It has stations in several Callaway towns and long-distance connections with the Buffum line at Fulton, the county seat. The new officers have announced their intention of rebuilding the lines and making the service first-class.

Legal.

NORFOLK, VA.—Following a suit in the Federal Court by the Franklin Trust Company, of New York, trustee for the holders of $1,000,000 of mortgage bonds of the Newport News Light and Water Company against the Peninsula Pure Water Company, of Hampton, Va., Judge Waddill has granted an injunction restraining the defendant from crossing the lines of the Newport News Company and from paralleling its lines at a nearer distance than three feet. The case is returnable for trial October 15. The Newport News Light and Water Company was founded by the late Collis P. Huntington. The Peninsula Water Company is financed through A. N. Chandler & Co., of Philadelphia. The charter of the defendant company, it is alleged, fails to give it public service rights.

MUELLER LAW UPHELD.—Judge Thomas G. Windes, in the Circuit Court, Chicago, has refused to enjoin the city authorities from issuing certificates under the Mueller law for the purchase of the local street railway companies in any sum not over $75,000,000. This was the first hearing in the case, and the matter will be taken to the Supreme Court of the State, from which an opinion is hoped for some time next month. The Mueller law was the act passed by the State Legislature under which the city of Chicago was authorized to issue certificates, in amount not exceeding $75,000,000, to acquire and operate the street railways of the city. A committee of taxpayers opposed to municipal ownership attacked in court the constitutionality of the law, and at the same time the legality of certain ordinances passed by the City Council of the city of Chicago also looking to the control by the city of the street car systems. The city filed a demurrer to the bill of complaint entered by the committee. The decision of Judge Windes upholds the constitutionality of the law, approves every step that the city had taken in following the provisions of the law, and dismisses the bill of complaint for want of equity. An important feature of the decision is that it gives to the city the right to carry parcels in the proposed street railway system. The court declared that there is nothing in the constitution of the State of Illinois which prevents the Legislature from giving to street railway companies permission to carry parcels.

Educational.

DREXEL INSTITUTE.—The Drexel Institute, Philadelphia, has issued a special circular as to its evening classes in engineering subjects. The following classes are offered, which can be variously grouped at will: 1, engineering, drawing; 2, mechanics and heat; 3, elements of chemistry; 4, engineering electricity; 5, advanced engineering electricity; 6, strength of materials and machine design; 7, advanced strength of materials and machine design; 8, thermodynamics and steam engineering; 9, plane surveying; 10, advance surveying; a, applied electricity; b, elementary mechanical engineering; c, telephony; d, advanced telephony. Work begins on October 1 and continues two evenings a week until March 27. Enrolment begins September 26. No fee for any class exceeds $10. Circulars can be had on application.

Obituary.

EDWARD KIRKLAND SHELMERDINE, of Philadelphia, is dead. Mr. Shelmerdine was connected with the Rapid Transit Company for many years, retiring several years ago. He was a brother of William H. Shelmerdine, a director of the Philadelphia Rapid Transit Company.

MR. D. O'DAY.—A cable message announces the death in the south of France, of Daniel O'Day. He was born in Ireland, Feb. 6, 1844. He came to this country when a very small child, was raised in Buffalo, and educated in the public schools there. In 1865 he went to the Pennsylvania oil regions, and was for many years active in the management of the transportation interests of the Standard Oil Company, of which he was a director. He accumulated a very large fortune, part of it in the electrical field. At the time of his death he was a director in the following corporations, among others: The Buffalo General Electric Co., president; Cataract Power & Conduit Co., International Railway Co., International Steam Pump Co., Lanyon Zinc Co., Niagara Falls Power Co., Venango Power & Traction Co.

Personal.

MR. J. A. KLEMAN, who was connected with the Sacramento *Bee*, has gone to Los Angeles to join his brother there in the manufacture of the Kleman high voltage switch and other electrical appliances.

MR. LOUIS GLASS.—A San Francisco dispatch states that General Manager Louis Glass, of the Pacific States Telephone & Telegraph Company, will be succeeded by a new man and that other changes will be made in the executive department of the corporation.

MR. J. SIDNEY CORBY, the well-known salesman with the Bryan Marsh Company, has been appointed special representative to look after the sales on Bryan Marsh tantalums and metalized filament lamps. Mr. Corby's many friends will be pleased to hear of his promotion.

FLETCHER-WESTINGHOUSE.—On September 12, Miss Clara Catherine Westinghouse, daughter of H. Herman Westinghouse, was married to Mr. Charles William Fletcher of New York at the Westinghouse residence at Kidders-on-Lake Cayuga. Two hundred relatives and friends from New York, Pittsburg and other places attended the wedding.

HON. CHARLES H. DUELL, Justice of the Court of Appeals of the District of Columbia, formerly United States Commissioner of Patents, and long a practitioner at the patent bar, has resigned his position as United States Judge and reentered active practice in association with Warfield & Duell, of 60 Wall St., New York, and the firm name will be Duell, Warfield & Duell.

MR. E. W. MOORE, president of the Electric Cable Company of Bridgeport, Conn., has an excellent article in the September issue of "System," entitled "Starting a Manufacturing Business," in which he describes the general conditions which the prospective manufacturer must face in entering the field, particularly the manufacturer of electrical supplies. The article is illustrated by a full-page portrait of Mr. Moore and by an exterior and interior view of the Electric Cable Company's plant, showing the system observed in shipping products and the labor-saving machinery used in this connection.

MR. P. A. B. WIDENER.—A recent item in the *New York Times* says: P. A. B. Widener, after his climb to fortune by way of Philadelphia tractions, became an ardent collector of paintings. James J. Hill began his first efforts in that direction about the same time. The two men, meeting recently, made a mutual confession. "Jim," said Mr. Widener, "I think I got off cheap. I cleaned up at a loss of only $200,000." Mr. Hill figured the cost of his hobby at about $2,000,000, but he didn't add that he had cleaned up. Whatever his lack of knowledge may have cost him in early days, it is conceded that his collection as it stands is one of the most notable, if not in the country, at least in the West."

MR. CHARLES F. BRUSH says: "The inventor's lot is not always a happy one. In defending my patents at first there was spent from $75,000 to $100,000 a year, and I paid half of it out of my own pocket. As it happened we ran right into a most extraordinary period of patent litigation and decisions. Patent rights had been shamefully abused in all directions. Farmers especially had suffered. A churn agent would come along, to be followed in a little while by a man who blackmailed the farmer into paying damages for infringement. Accordingly, the judges of the United States courts went to the other extreme, and for ten years, so far as I knew, not a single patent was sustained on a trial of the case. The Brush Company got into the very midst of this orgy of injustice, and we had to fight infringements every inch of the way."

MR. A. VIVIEN.—Advices from New England state that Alfred Vivien, the wireless telegraph electrician, is in Boston. Mr. Vivien is thirty-two years old and was born in the South of France. After having secured at the University of Marseilles his degrees, he remained in the university one year, the pupil of the celebrated French physicist, Mace de Lefinay. Immediately afterward, on the proposition of Professor Violle, member of the Institute, he was called to be head manager of the practical works at the Ecole Superieur d'Electricitié of Paris. One year later he went into the Industry, and became the assistant of Branley, the inventor of the "coherer." It was under Marconi that the young man came to know all the principles of wireless telegraphy. Mr. Vivien says that in four months easy communication will be permanently established for the public between Canada and Ireland. Eight hundred men are at work in their construction and Marconi himself will personally supervise their operation.

MR. R. S. BUCK.—It is announced by Sanderson & Porter, engineers and contractors, of New York, that Mr. Richard S. Buck, Am. Soc. C. E., has been admitted as a member of the firm. Mr. Buck is now consulting engineer of the Department of Bridges, New York City, engaged on the Manhattan and Blackwell's Island Bridges, and will retain this connection for a time at least. The firm of Sanderson & Porter executes work in various branches of civil, mechanical and electrical engineering and construction. During the past ten years it has become well known by its connection with the design, construction and operation of a number of hydroelectric, power, lighting and railway development enterprises throughout the country. Work now in hand includes the general design and construction of two hydroelectric plants on the Pacific Coast comprising about 50,000 horse power of equipment; the power house equipment and transmission system of the McCall Ferry Power Company, on the Susquehanna River; extensive additions to the New Orleans Street Railway and Lighting system, and to those of the Mahoning & Shenango Railway & Light Company of Ohio and Pennsylvania. The firm now consists of Messrs. Edwin N. Sanderson, H. Hobart Porter, Francis Blossom, Richmond Talbot and Richard S. Buck.

News of the Trade.

CONSTRUCTION AT NEW HAVEN.—Frank G. Tester and Theodore Schmolk, who have been connected with John J. Dinnan for the past 15 years, have opened a new shop at 533 State Street, where they will conduct a general electrical business. Estimates will be given on all kinds of work.

ALLEN LIQUID FLUX.—L. B. Allen Co., Inc., of Chicago, is in receipt of the following letter from one who has used its material: "I beg to acknowledge receipt of the sample of Allen Liquid Flux sent me on the 24th of July. I have tried the liquid on several large commutators, and like it better than anything I have ever used. I have asked the company to place an order with you. Allen Liquid Flux or nothing for commutators."

MODERN LUBRICATION of the engine bearings is increasing in interest and is a noteworthy feature in the equipment of up-to-date engine rooms. Leading mechanical engineers are specifying oiling systems on account of the economy with which oil is used, the saving of time in attention over the old methods and saving of oil in handling, as with an oiling system it is only necessary to empty the contents of a barrel direct into the system, all of which combines to simplify conditions. Among the concerns who have purchased the White Star oiling systems from the Pittsburg Gage & Supply Co., Pittsburg, Pa., during the past few weeks are: The Page Manufacturing Company, New Bedford, Mass.; Merchants' Ice & Coal Co., St. Louis, Mo.; Columbia Improvement Co., Columbus, Ga.; Atlantic Electric Light & Power Co., Atlantic City, N. J.; Power & Mining Machinery Co., Cudahy, Wis.

STAPLES AND CLEATS.—Mr. E. J. Burke, the president of the Blake Signal & Manufacturing Company, Boston, Mass., says: "Our sales of staples and cleats to the smaller telephone companies, both independent and Bell, are beginning to increase rapidly. These smaller companies are beginning to realize, as the larger companies did sometime ago, that although the first cost of our staples is greater than that of bare staples, different kinds of tacks or other forms of metallic insulated wire support, they are a decided economy in the end. The use of the Blake insulated staple prevents numerous short circuits, grounds on wiring and circuit interruptions, which are not only expensive to find, but annoying to the telephone subscriber, and give him the idea that his service is poor, and that he is not being looked after properly. Our business in these little articles has likewise so increased in Canada that we have established an agency there, the Norton System Telephone Manufacturing Company, of Toronto and Halifax.

WESTERN ELECTRIC PICNIC.—An ideal day for a picnic September 8, 1906, was ushered in with a bright sky and cool breeze, and bade fair to see one of the liveliest of those vigorous and healthy outings, for which the drafting departments of the Western Electric Company of Chicago are becoming famous. The place, Glenwood Park, Ill., on the beautiful Fox River was reached after an hour's ride on the Elgin and Aurora third-rail system. A short, rapid and noisy game of baseball between the Hawthorne and Clinton Street factions, resulted in the latter team winning the handsomely decorated pennant, declaring them champions for 1906. On the cinder track, a list of strenuous athletic events kept the cracksmen busy for an hour, with the following results: Mr. H. L. Ray won the 100-yard dash; Messrs. A. J. Parks and E. O'Connor won the pick-a-back race; the Indian wrestling match was won by Mr. H. M. Cooper, a direct descendant of the author-hero of "Leather Stocking Tales." The potato race was gathered in by Mr. W. T. Patton; Mr. Paul Hoffman jumped into fame, and won the prize in the running board jump; Messrs. J. F. Baginski and W. Graff captured the three legged race. Mr. Baginski also won the sack race. The athletics of the day ended by a glove contest, exceeding in interest the recent Goldfield affair. Mr. Al Pruessman went down and out in the third round, before the prowess of Mr. Nic Sima. In the second bout, Mr. Sima met his match in the scientific sparring of his young opponent, Mr. R. D. Osgood, and divided honors about equally. A bountiful repast was spread under the trees, to which 250 hungry draftsmen did ample justice, after which all hands repaired to the pavilion where they were regaled by a program, which began with an address by Mr. J. G. Crawford, formerly chief draftsman, who presented the prizes with a few appropriate remarks, followed by several musical numbers and sketches. A bunch of knocks, as sung by the Clinton Quintette was vociferously applauded. It was a jolly, tired train-load, which pulled in to the city at an early hour, and every one declared themselves better acquainted with their fellow men, and that the cause of "Good Fellowship and Loyalty to the Firm"—the draftsman's motto—had received another generous boost.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPT. 11, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

830,501. PROTECTING BUSHING FOR ELECTRIC CIRCUIT WIRES; John H. Goehst, Chicago, Ill. App. filed Feb. 16, 1905. A sleeve or bushing adapted to be inserted through openings in a wall to protect the circuit wires. Is threaded like an ordinary incandescent lamp shell and has sheet metal flanges or nuts to engage such threads and hold the sleeve in place.

850,533. ELECTRIC BRAKE; Frank L. Sessions, Columbus, O. App. filed Jan. 17, 1905. Complete circuits for a conveyor hoist including a magnet operated brake and a circuit for energizing the same to prevent too rapid descent of the elevator conveyor by gravity. Depends on the motor acting as a generator.

830,537. TIME ELEMENT DEVICE; John G. Statter, Birmingham, Eng. App. filed July 31, 1905. In order to avoid the defect of a dash pot in a circuit breaker when used to prevent immediate action, the patentee has an oil suction device which prevents movement of the switch arm at its inception, but allows free movement after a certain time interval.

830,568. TROLLEY CONTROLLING APPARATUS; Frank B. Case, Schenectady, N. Y. App. filed March 10, 1905. The trolley and the collector shoe both have pneumatic retrievjng devices and the usual engineer's valve has special ports by which one or the other retrieving device may be made operative as desired.

830,572. CLAMP FOR ELECTRICAL CONDUCTORS; Scott C. Cutter, Oswego, Ill. App. filed July 3, 1905. A pair of metallic plates or washers are connected by a central thumb screw so as to clamp the terminals on opposite sides thereof. The plates have a slight looseness on the thumb screw.

830,575. TELEPHONE SYSTEM; William W. Dean, Chicago, Ill. App. filed Dec. 6, 1901.

830,583. COMBINATION TELEPHONE TRANSMITTER AND RECEIVER; Charles C. Gilchrest, New York, N. Y. App. filed Oct. 12, 1905.

830,585. INSULATOR FOR TELEGRAPH AND TELEPHONE WIRES; Salathiel V. Graves and Samuel H. McDaniel, McFall, Mo. App. filed Nov. 14, 1905.

830,598. INCANDESCENT LAMP; Gottlob Klumpp and Henry F. Herman, Brooklyn, N. Y. App. filed Sept. 9, 1905. Mechanical construction of a lamp socket adapted for high or low illuminations. The socket has a ventilated chamber containing a resistance and this resistance may be cut into or out of the lamp circuit by rotating the socket.

830,628. SWITCH FOR ELECTRIC CIRCUITS; Eddy R. Whitney, Lynn, Mass. App. filed June 2, 1904. Relates to a type of controllers for machine tools having a throw both sides of a neutral position for forward and reverse. Includes a specially formed cam which prevents the arm being thrown past the neutral without pausing and making a slight retrograde movement at such position.

830,639. PROCESS FOR THE ELECTROLYTIC PRODUCTION OF COPPER; Johannes A. Borchers, Aachen, Parl R. Franke, Eisleben, and Franz E. Gunther Aachen, Germany. App. filed Sept. 21, 1905.

830,674. MACHINE FOR ELECTRICALLY WELDING; Louis S. Rolland, Brussels, Belgium. App. filed Sept. 28, 1905. Machine for electrically welding hoop irons, wires, cables, and similar articles. Has a stamping mechanism for removing the bur which results in the welding so that the welded joint is invisible.

830,675. ATTACHMENT FOR TELEPHONE TEST SETS; George L. Rosenberger, Manassas, Va. App. filed Sept. 12, 1905.

830,686. TROLLEY POLE CONTROLLER; John J. Tartt, Los Angeles, Cal. App. filed Dec. 28, 1903. A magnetic solenoid is connected to retrieve the trolley pole when energized, and a circuit is completed for this purpose by the movement of the trolley harp which is hinged in a separate section at the upper end of the pole.

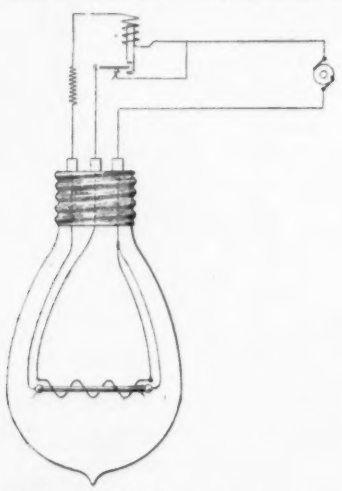
830,696. TELEPHONE SWITCH-HOOK; James A. Wotton, Atlanta, Ga. App. filed June 17, 1905.

830,698. ELECTRIC LAMP; Albert Ackerman, Pittsburg, Pa. App. filed Oct. 4, 1899. A form of Nernst lamp, having the usual glower in a vacuum bulb, the glower being surrounded with a spiral filament by which it is initially heated. The filament is afterward automatically cut out of circuit.

830,708. COMBINED CANDLE BASE AND SOCKET FOR MINIATURE ELECTRIC LAMPS; John H. Goehst, Chicago, Ill. App. filed April 11, 1904. A base in the form of a candle, has an ordinary Edison threaded shell at one end, and a miniature lamp socket at the other end, whereby it can be screwed into an ordinary socket and employed in connection with miniature lamps.

830,718. APPLIANCE FOR TRACING COURSES ON CHARTS; Harold E. S. Holt, Farnborough, Eng. App. filed Nov. 26, 1904. Two motors are connected to right angularly arranged lead screws which impel a carriage in the direction of their compound movement. The motors are driven by circuits so that their speed corresponds to the course of the vessel, winds, tides, currents, and other factors.

830,770. AUTOMATIC RESETTING SWITCH. Samuel H. Couch, Boston, Mass. App. filed Oct. 2, 1905. The telephone outfit has a



830,698.—Electric Lamp.

group of switch levers corresponding to the various extension lines, and any one of which may be manually operated. All are repositioned by putting the receiver on the hook.

830,780. CIRCUIT CLOSER FOR LOCKS. Anthony Glass, Cleveland, O. App. filed Jan. 31, 1906. A small lever in the path of the key has a switch arm engaging two spring contacts to close an alarm circuit.

830,800. GAME AND TOY. Charles G. Mortimer, Jr., New York, N. Y. App. filed July 26, 1905. Two solenoids are arranged to imitate the cylinders of a vertical compound engine and a lever is arranged to vary the make and break circuit so as to reverse the direction of rotation when desired.

830,801. GAME AND TOY. Charles G. Mortimer, Jr., New York, N. Y. App. filed Jan. 16, 1906. Construction of motor having a revolving notched disc which moves in proximity to the poles of a magnet.

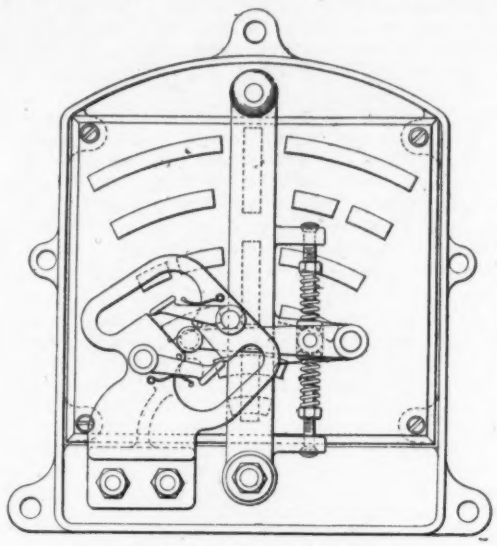
830,812. PROTECTIVE APPARATUS FOR COMPENSATOR DYNAMOS. Henry H. Wait, Chicago, Ill. App. filed Jan. 18, 1904. Relates to three-wire system in which compound-wound compensator dynamos are employed. Provides circuit closing switch adapted to make the compensators run as simple shunt-wound machines in case they get out of balance with one another.

830,849. DYNAMO ELECTRIC MACHINE. Williard F. Richards, Buffalo, and William A. Turbanye, Lancaster, N. Y. App. filed Aug. 12, 1905. Relates to mechanical features and particularly an oil thrower adjacent to the bearings which prevents any oil creeping into the machine to injure the windings or commutator.

830,918. ANODE. John Nelson, Peru, Ill. App. filed June 28, 1906.

830,919. DEVICE FOR IGNITING AND EXTINGUISHING GAS. Richard N. Oakman, New York, N. Y. App. filed June 2, 1905. The valve for the gas burner is operated by a small pneumatic cylinder, and the movements of the piston are effective to swing an arm into contact with the tip to make a spark and produce the ignition.

830,921. MEANS FOR TRANSMITTING ELECTRICAL IMPULSES.



830,628.—Switch for Electric Circuits.

Francis L. Orr, Thurman, Ia. App. filed July 19, 1905. A device for preventing cattle from leaning against a wire fence. Has a small induction coil to transmit electric impulses to the fence at periodic intervals.

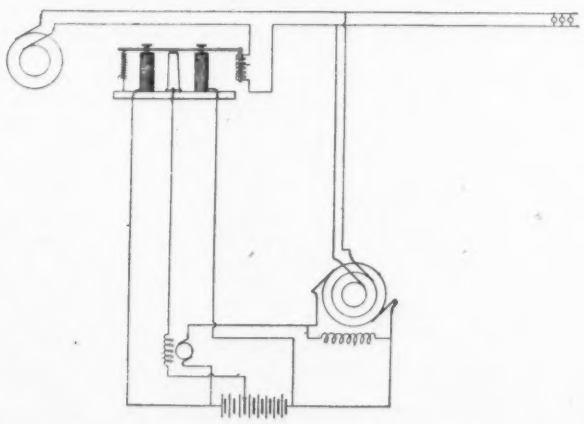
830,924. CURRENT RECTIFIER. Franz Pawlowski, Vienna, Austria-Hungary. App. filed Nov. 14, 1904. A current rectifier, including two electrode plates, one composed of aluminum, and a plate of hemi-sulfid of copper arranged between the two electrode plates.

830,938. POTENTIAL INDICATOR. John B. Taylor, Schenectady, N. Y. App. filed Jan. 1, 1905.

830,947. MEANS FOR STARTING ALTERNATING CURRENT MACHINES. Obed F. Whitehurst, Schenectady, N. Y. App. filed Jan. 28, 1905. An alternating current machine has a circuit including the usual lamps and a voltage regulator, and means for impressing the voltage of said circuit upon the whole or a portion of said regulator.

830,971. ELECTRIC CLOCK. Ulysses L. Collins, St. Louis, Mo. App. filed Sept. 18, 1905. The clock has a power shaft with a ratchet wheel normally engaged by spring impelled pawl. This pawl is periodically retracted by a magnet.

830,975. APPARATUS FOR PRODUCING HIGHLY-OZONIZED AIR



830,982.—System of Electrical Distribution.

OR OXYGEN. Auguste Dechaux, Paris, France. App. filed April 28, 1904.

830,981. TELEPHONE SYSTEM. Alfred H. Dyson, Chicago, Ill. App. filed April 17, 1905.

830,982. SYSTEM OF ELECTRICAL DISTRIBUTION. Justus B. Entz, Philadelphia, Pa. App. filed Mar. 28, 1905. Provides for adding and subtracting electromotive force to a direct current circuit, which is so related to an alternating current circuit as to cause the direct current circuit to give or receive energy from the alternating circuit through a rotary converter.

830,001. RECEIVER-HOOK FOR TELEPHONES. Denis Howard, Binghamton, N. Y. App. filed Jan. 16, 1906.

831,016. ELECTRIC DOOR STRIKE. George N. Parker, Boston, Mass. App. filed July 9, 1904. Relates to mechanical features, particularly the provision of balls in the keeper for the latch which allow the keeper to be more freely withdrawn.

831,025. LOCOMOTIVE ENGINEER'S ALARM. Edward McClintock, Merriam Park, Minn. App. filed May 16, 1904. A pair of special trolleys are laid adjacent the usual track rails and a form of controller on the locomotive cab may be positioned to display signals or to include telegraph instruments as desired.

12,530. ELECTRICAL CIRCUIT CONTROLLER. Harry W. Leonard, Bronxville, N. Y. App. filed July 2, 1906. Relates to mechanism for insuring the proper actuation of motor starters by which they cannot be manipulated to draw a destructive arc.